Naval Sea Systems Command

Environment, Safety, and Health (ESH) Integration Guide for Program Managers

Office of Environmental Protection and Occupational Safety and Health
SEA 00T

February 2000

NOTE: This document provides guidance to meet mandatory ESH requirements contained in DOD Regulation 5000.2-R and SECNAVINST 5000.2B.
Exclusion. Executive Order 12344, (statutorily prescribed by PL-98-525 (42 USC 7158, note)), establishes the responsibilities and authorities of the Deputy Commander, Nuclear Propulsion Directorate (SEA 08) [who is also the Director, Naval Nuclear Propulsion Program, NOON, in the Office of the Chief of Naval Operations] over all facilities and activities which comprise the Program, a joint Department of Energy (DOE)/Navy organization. These responsibilities and authorities include all technical and logistical matters related to naval nuclear propulsion. Nothing in this guide alters or modifies these responsibilities and authorities. Accordingly, the Deputy Commander, Nuclear Propulsion Directorate will be consulted in all matters pertaining to, or affecting, nuclear propulsion plants and associated nuclear support facilities.

"WE ENGINEER AMERICA'S FLEET"

COMMENTS AND SUGGESTIONS

Our goal is for this guide to be a useful document for the program offices. If you have comments or suggestions on how to improve the guide, corrections that should be made, or ideas on additional information that should be included please let us know. The point of contact for this guide is Mr. Abdi Nazari, who may be reached by telephone at (703)602-3594 x210 or DSN 332-3594 x210, or by EMAIL at nazaria@navsea.navy.mil or by completing the form below and mailing it to:

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Thank you.

NAVSEA ESH Integration Guide for Program Managers

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SECTION 1. INTRODUCTION

1.1. ENVIRONMENT, SAFETY, HEALTH (ESH) UPDATE

This guide replaces the NAVSEA Program Manager's Environmental Guide and reflects the requirements to integrate ESH considerations into the systems engineering process as required in DOD Regulation[1] and SECNAV instruction[2]. The DOD Regulation states that all programs, regardless of acquisition category (ACAT), shall conduct ESH analyses in accordance with applicable federal, state, interstate, and local environmental laws and regulations, Executive Orders (E.O.s), treaties, and agreements. This guide provides assistance for Program Managers (PMs) to properly tailor their ESH integration efforts, depending on the complexity and maturity of the system that they are managing.

This guide is not prescriptive but, rather, provides assistance for PMs.

1.2. DEFINITION OF TERMS

Appendix A provides a "List of Acronyms and Abbreviations" used in this guide. This guide uses the words shall, will, must, should, may, and can throughout. Shall, will, and must are directive in nature and require mandatory compliance. These terms are limited only to those mandatory requirements contained in DOD Regulation 5000.2-R and SECNAVINST 5000.2B. Should is used as a strong, but discretionary, recommendation for meeting the mandatory requirements. May or can are used for optional recommendations.

"Program Manager" (PM) in this guide refers to a broad spectrum of acquisition managers, ranging from Ship Acquisition Program Managers (SHAPMs) to project managers of smaller ACAT programs and projects. PM is also used as an umbrella term for actions accomplished by the PM's supporting Program Office.

In the context of this guide, the term system is broadly defined as all end-items from major systems (e.g., ships) to components (e.g., feed pumps).

The Defense Acquisition University defines[3] systems engineering as: "An interdisciplinary approach to evolve and verify an integrated and life-cycle balanced set of system product and process solutions that satisfy stated customer needs."

In the context of this guide, ESH Total Ownership Cost (TOC) is defined as the ESH Life Cycle Cost (LCC) plus related infrastructure costs. For example, the TOC associated with the

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[1] DOD Regulation 5000.2-R, Mandatory Procedures for Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Programs, (Change 4) dated 12 May 1999; p. 6, Part 4.
[2] SECNAVINST 5000.2B, Implementation of Mandatory Procedures for Major and Non-Major Defense Acquisition Programs and Major and Non-Major Information Technology Acquisition Programs, dated 6 December 1996, p. 7, Enclosure (4).
[3] Intermediate Systems Planning, Research, Development & Engineering (SYS201) Course Book, Seventh Edition, Defense Acquisition University, dated December 1996, p. 3-2.

use of cadmium includes the cadmium-related LCC plus the cost of the medical infrastructure to conduct the required medical surveillance for personnel exposed to cadmium.

1.3. APPLICATION

This guide applies to the NAVSEA acquisition workforce and provides ESH integration guidance for both new and in-service ship and ship-related acquisition programs. Afloat aspects of ESH integration are addressed only to the extent of their impact on the acquisition process and how this process ultimately affects life cycle ESH issues.

1.4. BACKGROUND

Traditionally, DON has followed a comprehensive strategy of ESH compliance necessary to meet the growing list of new federal, state, and local ESH laws and regulations. The trend in the number of ESH laws passed in this century is shown in Figure 1.

As early as 1989, DOD issued pollution prevention policy that emphasized less use of hazardous materials in processes and products, as distinguished from end-of-pipe management of hazardous waste.[4] Recognizing the role of the acquisition community in managing ESH issues, DOD established policy[5] requiring effective integration of ESH considerations into the systems engineering process[6] of programs. Even before this policy was established, DOD issued MIL-STD-882C,[7] providing PMs with the methodology and detailed task descriptions to support the management of ESH-related hazards. In December 1992, the DOD Inspector General (IG) found that DOD generated more than 80% of its hazardous waste in the production, operation, and maintenance of weapon systems. This report also concluded that acquisition managers had poor visibility of the environmental impacts and costs associated with using hazardous materials in the design and development of their systems.[8]

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[4] DOD Directive 4210.15, Hazardous Materials Pollution Prevention, dated 27 July 1989; p. 1.

[5] DOD Instruction 5000.2, Part 6, Section I, System Safety, Health Hazards, and Environmental Impact, dated 23 February 1991; p. 6-I-1.

[6] DOD 5000.2-R requires PMs "...ensure that a systems engineering process is used to translate operational needs and/or requirements into a system solution that includes the design, manufacturing, test and evaluation, and support processes and products."

[7] MIL-STD-882C, System Safety Program Requirements, dated 19 January 1993.

[8] DOD IG Report, Final Report on the Inspection of Hazardous Waste Minimization in the Department of Defense, dated 22 December 1992; p. ii.

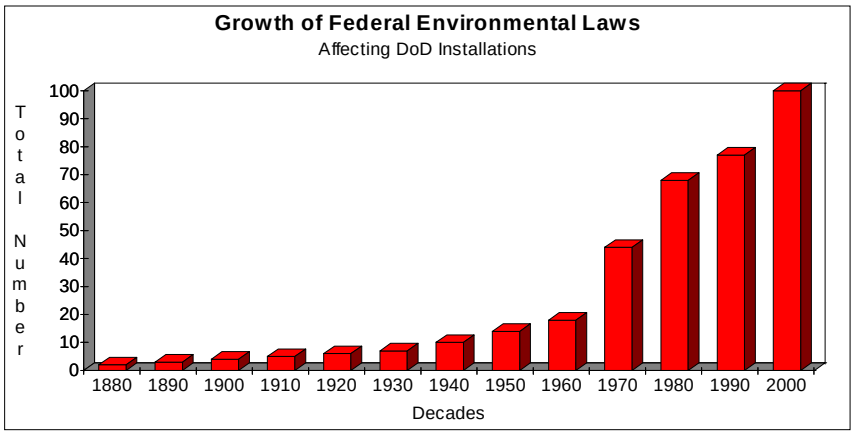

FIGURE 1.1 Trend in ESH Laws Passed This Century

In December 1993, the Office of the DOD IG found that DOD was not accomplishing its mission in a manner consistent with national environmental laws and policies.[9] Although the 1991 version of DOD Instruction 5000.2 required PMs to conduct a Programmatic Environmental Analysis (PEA), over a third of the programs surveyed in 1994 admitted that they had not integrated environmental concerns.[10]

Recognizing the President's policy to prevent, rather than handle, treat, and dispose of pollutants across the Federal government, the Under Secretary of Defense issued a policy statement on pollution prevention in December 1993.[11] This policy acknowledged the need for DOD to redefine its environmental focus away from traditional end-of-pipe controls toward pollution prevention. The policy reaffirmed that the acquisition community holds the key to preventing pollution that results from the acquisition of new and modified weapon and support systems. PMs were specifically required to apply life cycle analysis and total cost accounting principles to all projects to meet pollution prevention requirements.

Congress also recognized the importance of environmental considerations in acquisition programs. In 1994, Congress required[12] the Secretary of Defense (SECDEF) to issue guidance on how to achieve the purposes and intent of the National Environmental Policy Act (NEPA) for major defense acquisition programs. In addition, Congress mandated that the SECDEF analyze environmental costs, as an integral part of the LCC analysis.

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[9]Audit Report from the Office of the Inspector General, Environmental Consequences Analyses of Major Defense Acquisition Programs, (Report Number 94-020) dated 20 December 1993; p. i.

[10]Defense Acquisition Management College, Technical Report, TR-1-95, Environmental Practice in Program Management Offices, dated January 1995, table 4-3.

[11]Under Secretary of Defense Memorandum, Executive Order 12856, Federal Compliance With Right-To-Know Laws and Pollution Prevention Requirements, dated 10 December 1993.

[12] Public Law 103-337, Section 815, Environmental Consequences Analysis of Major Defense Acquisition Programs, dated 5 October 1994.

The Navy has historically maintained safety and health programs to protect its personnel and property. The Chief of Naval Operations (CNO) has traditionally established policy[13] and managed the Navy Occupational Safety and Health (NAVOSH) program, and the Assistant Secretary of the Navy (Installations and Environment) (ASN(I&E)) is the Designated Safety and Occupational Health Official for the DON. CNO issued additional policy[14] for tailored procedures applicable to forces afloat.

The PM's system safety program must consider & coordinate with the NAVOSH program and other safety and health disciplines.

The relationship between the NAVOSH program and a PM's system safety program is critical for effective protection of DON personnel and materiel. The PM's system safety program, while focused on the design aspects of the system, must include consideration of and coordination with the broader aspects of the NAVOSH program and other applicable safety and health disciplines such as nuclear safety, range safety, explosive and ordnance safety, chemical and biological safety, laser safety, occupational safety and health, as well as any others.

NAVSEA has an Acquisition ESH Integration Workshop to assist PMs and their staffs.

Recently, the DOD acquisition community has begun developing training programs that provide assistance to effectively manage the integration of ESH considerations into the systems engineering process. This guide and the companion Acquisition ESH Integration Workshop are integral parts of that effort at NAVSEA. Personnel within the NAVSEA acquisition workforce are encouraged to participate in the workshop at the earliest availability. The guide provides assistance to PMs in effectively managing ESH risks through a process that first seeks to eliminate hazards from design. Where the design contains residual hazards, other mitigation approaches are considered that can include external devices, warnings, and procedures.

1.5. GUIDE ARRANGEMENT

The first three Sections of this guide contain information to assist the reader in understanding the basic requirements. Sections 4 through 8 address the five topics contained in Paragraphs 4.3.7 of both DOD Regulation 5000.2-R and SECNAVINST 5000.2B. Each of these five Sections further describes the process by asking five basic questions: (1) What is the requirement to integrate ESH considerations? (2) Why integrate ESH? (3) Who should integrate ESH? (4) How should ESH be integrated? (5) When should ESH be integrated? The last two Sections discuss programmatic and management issues, respectively.

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[13] OPNAVINST 5100.23E, Navy Occupational Safety and Health (NAVOSH) Program Manual, dated 15 January 1999.

[14] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, dated 19 January 1994.

SECTION 2. PURPOSE

This guide should be used by all NAVSEA acquisition personnel in meeting the mandatory requirements for integrating ESH considerations into the systems engineering process.

NAVSEA acquisition personnel should develop a commitment to the ESH ethic within their respective programs and functional support areas. This commitment should be instilled in each individual in the acquisition work force, regardless of the size of the program, the acquisition strategy, or the phase of the program within the overall acquisition process. This guide is intended to assist NAVSEA acquisition personnel in formulating and implementing the ESH ethic. Section 10.1 provides guidance on establishing an ESH Policy that PMs may wish to issue for their individual programs.

Four general principles to remember about ESH integration are:

- PMs must integrate ESH considerations so that human health and the environment are protected at the lowest TOC.
- Industry and DOD have proven that well planned and effectively executed ESH initiatives can pay for themselves over the life cycle.[15]
- ESH issues are now beginning to seriously threaten operational readiness and global interoperability.[16]
- Integration of ESH considerations is best done early in the program; however, savings can be realized in any phase of the acquisition process - even within in-service programs.

These four principles form the centerpiece of why we cannot afford to miss the opportunity to improve the way we design and build ships and ship systems. Proper use of this guide will minimize the resources required for programs to adequately plan and fully implement ESH initiatives.

ESH integration includes hazard management and supports overall operational risk management.

Integrating ESH considerations into the systems engineering process adds value to the system. It is also an integral part of successful cost, schedule, and performance risk management required by DOD Regulation 5000.2-R. ESH integration includes hazard management and supports overall operational risk management by identifying, categorizing, and mitigating ESH hazards, and by providing a communication forum for acceptance of residual ESH risks.

[15] Buchholz, Rogene A. "Principles of Environmental Management," Englewood Cliff, NJ: Prentice-Hall, 1993.
[16] CNO's Memorandum, Minimizing Environmental Policy Impacts on Fleet Operations, dated 14 October 1997.

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SECTION 3. INTEGRATING ESH INTO THE SYSTEMS ENGINEERING PROCESS

DOD Regulation 5000.2-R states that ESH analyses shall be conducted for all programs, regardless of ACAT. ESH analyses shall be conducted to integrate ESH issues into the systems engineering process and to support the development of the Programmatic ESH Evaluation (PESHE). The PESHE is a part of the program's Acquisition Strategy (AS). The PM may also elect to develop an internal ESH Master Plan (ESHMP)[17]. The ESHMP describes the detailed activities necessary to carry out the PM's integration of ESH consideration into the systems engineering process. Effective integration of ESH issues into the systems engineering process is better understood by answering five basic questions: *What* is ESH integration? *Why* should it be implemented? *Who* should implement it? *How* should it be implemented? *When* should it be implemented?

The integration of ESH considerations into the systems engineering process and the PESHE are required of all programs, regardless of ACAT.

- *WHAT?* Simply stated, ESH integration into the systems engineering process is balancing five key elements of ESH considerations on an equal basis with all other performance-related issues. These five key elements are shown in Figure 3.1. DOD and DON have both indicated that two of these areas will be expanded in the next policy updates. "Environmental Compliance" will be expanded to "ESH Compliance" so that compliance to occupational safety and health regulations is included. "System Safety" will be expanded to "Safety" so that consideration of larger safety issues are integrated into the systems engineering process.

"Environmental Compliance" will be expanded to "ESH Compliance" and "System Safety" will be expanded to "Safety."

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

ENVIRONMENTAL COMPLIANCE

SYSTEM SAFETY AND HEALTH

HAZARDOUS MATERIALS

POLLUTION PREVENTION

FIGURE 3.1 Five Key Elements of ESH Analyses

- *WHY?* DOD requires all PMs to integrate ESH considerations into the systems engineering process. Figure 3.2 includes some of the reasons why the integration of ESH considerations into the systems engineering process makes good business sense.

[17] DOD Regulation 5000.2R, Section 3.6.

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IT CAN PROTECT HUMANS AND THE ENVIRONMENT.

IT CAN SAVE MONEY.

IT CAN SAVE TIME.

IT CAN IMPROVE THE SYSTEM.

IT CAN REDUCE LIABILITIES.

IT CAN SUPPORT OPERATIONAL READINESS.

IT CAN HELP PUBLIC IMAGE.

FIGURE 3.2 Why Integrating ESH Considerations Makes Good Business Sense

- *WHO?* PMs have the responsibility to ensure that this integration and related analyses are accomplished.
- *HOW?* The integration of ESH considerations into the systems engineering process must be done from a life cycle perspective because the benefits of ESH integration are realized over the life of the system, including disposal. ESH integration is not a separate process.
- *WHEN?* Like other systems engineering considerations, the integration of ESH is best done during programmatic analyses and design trade studies. The relative degree to which designs may be influenced over the acquisition life cycle is shown in Figure 3.3.

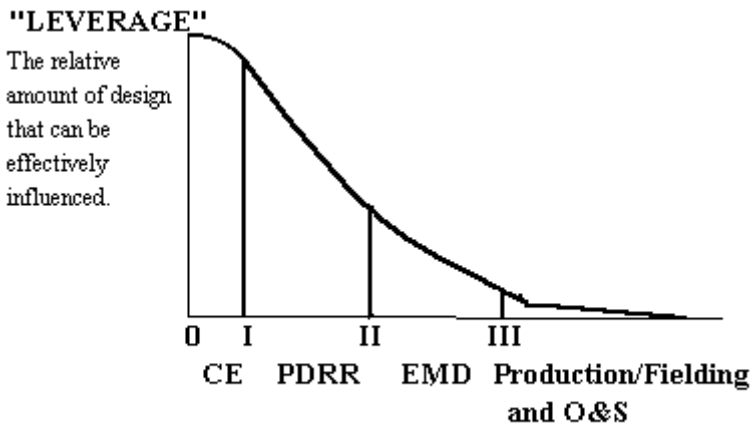

FIGURE 3.3 ESH Integration - More Effective If Done Early In The Acquisition Cycle

The following sections will address the integration of *each* of the five key ESH elements in the context of *What*, *Why*, *Who*, *How*, and *When*.

SECTION 4. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)[18]

4.1. WHAT IS NEPA?

The goal of NEPA is better decisions, not necessarily better documents.

NEPA is one of the oldest environmental laws actively enforced. NEPA is a procedural law, which means enforcement is based on an individual complying with the procedures outlined in implementing regulations[19]. Federal NEPA implementing regulations require Federal agencies to consider the impact of proposed actions on the human environment before the Federal agency decides to take any action. In addition to the Federal implementing regulations, DON has issued its NEPA implementing policy[20]. Decisions to take actions must be documented and, depending on the proposed action, these decisions may include public involvement. The purpose of the law and the implementing regulations is not to prepare better documents but to make better decisions. The NEPA thought process (i.e., analysis) is intended to help public officials make better decisions based on an understanding of environmental consequences and to support actions that protect, restore, and enhance the environment. NEPA serves as an umbrella under which proposed actions are analyzed for compliance to substantive laws (i.e., laws that can be enforced through fines and imprisonment). These laws include all aspects of environmental and human protection, such as the Marine Mammal Protection Act, the Endangered Species Act, and the Clean Air Act. DOD Regulation 5000.2-R requires the formal inclusion of NEPA in the acquisition decision-making process. SECNAVINST 5000.2B provides additional guidance on implementing NEPA within DON acquisition programs.

NEPA applies to any Federal action affecting the human environment inside the U.S., its territories and possessions. Proponents for proposed actions having the potential for significant effects on the environment outside the geographical borders of the U.S., its territories and possessions must also take environmental considerations into account per E.O. 12114[21] and DODD 6050.7.[22]

4.2. WHY INTEGRATE NEPA?

NEPA analysis is part of good program management and planning. Some costs must be incurred by the PM in conducting the analyses, developing documentation, and implementing mitigation actions. Effective integration of NEPA planning and analysis will result in better decisions, including cost effective mitigation of impacts resulting from proposed actions.

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[18] 42 USC 4321-4370d
[19] 40 CFR 1500-1508.
[20] OPNAVINST 5090.1B CH-1, Environmental and Natural Resources Program Manual, dated 2 February 1998.
[21] E.O. 12114, Environmental Effects Abroad of Major Federal Actions, dated 4 January 1979.
[22] DODD 6050.7, Environmental Effects Abroad of Major Department of Defense Actions, dated 31 March 1979.

Application of the NEPA thought process provides excellent support in making informed acquisition decisions. Failure to apply NEPA can cause program delays, unfavorable public protest, and adverse court rulings.

Failure to apply the NEPA thought process can cause adverse program impacts.

NEPA is not complicated if PMs understand its most basic premise: *Before deciding to take the action, think about (i.e., analyze) what effect the proposed program action could potentially have on the human environment and consider implementing reasonable mitigation concepts.*

PMs can minimize schedule risks to proposed actions, such as system performance testing to support operational readiness validation, through early NEPA planning and analyses. Program delays, caused by court injunctions under NEPA or other environmental laws, can adversely impact milestone decisions and operational readiness issues. Operational readiness has recently come to the forefront of program management at the highest levels of DON. The ASN (RDA) has issued a policy memorandum that addresses his concern that environmental constraints threaten optimum operational use of systems delivered to the fleet[23]. NEPA planning and analyses are effective tools in identifying and mitigating potential operational "show-stoppers."

Program reviews (e.g., program milestone reviews) often include Milestone Decision Authority (MDA) review of the PM's planned NEPA actions for the next phase and the associated planning to support such actions. Some advisory boards (e.g., the Weapon System Explosives Safety Review Board (WSESRB)) now require PMs to address NEPA status during their program reviews.

4.3. WHO SHOULD INTEGRATE NEPA?

4.3.1. Actions for which PMs are Action Proponents

DON policy[24] identifies PMs as the NEPA proponent of proposed actions for which they are responsible. In most cases, these actions involve validation of technical performance through Developmental Testing (DT). In the case of DT, the PM has the responsibility for selecting how, when, and where the DT will be conducted. The PM also has the responsibility for funding DT and the associated NEPA analysis and documentation. To reinforce the need for the acquisition community's commitment in this area, DOD has assigned the ASN(RDA) as the final approval authority for all system-related NEPA and E.O. 12114 documentation. Within DON, this authority has been delegated to appropriate lower levels of

PMs are the NEPA proponents for their actions and are responsible under the law for NEPA compliance.

[23] ASN(RDA) Memorandum, Minimizing Environmental Policy Impacts on Fleet Operations, dated 13 January 1998.
[24] OPNAVINST 5090.1B CH-1, p. 2-2.

authority[25]. DON fully supports effective NEPA implementation; the PMs, as action proponents, must ensure program compliance with NEPA by properly planning documentation, allowing sufficient time for the NEPA analysis and documentation review, and budgeting funds for any necessary mitigation effort cited in their approved NEPA documentation. Depending on the specific proposed action and its potential for environmental impact, a public scoping meeting and hearing may need to be conducted. PMs should work closely with SEA 00T, SEA 00L, SEA 00D and the installation, test range, or facility at which the impact may occur to ensure full compliance with the requirements. PMs should remember that their program schedule and budget will be at risk if they do not comply with NEPA.

4.3.2. Proposed Actions involving Other Proponents

During the development of a system, PMs are not the proponents for all proposed actions. Determining the individual who controls the proposed action is the best way to identify the proponent.

OPTEVFOR is the action proponent for OT; and the CINCs are the action proponents for fielding/homeporting.

In the case of Operational Testing (OT), the PM is prohibited by law from controlling the OT and the assessment of the system's operational suitability. In the DON, the independent OT organization is the Operational Test and Evaluation Force (OPTEVFOR). In the case of OT, OPTEVFOR is the action proponent.

Deciding the numbers of systems to be fielded, where they are to be home-ported, and when they are to be fielded is another set of actions for which the PM is not the action proponent. In this case, the Commanders In Chief (CINCs) of the fleets control those decisions and are the proponents for these fielding/home-porting actions.

The PM plays an active role to support OPTEVFOR for OT and the CINCs for fielding/homeporting, but does not take the lead in these actions. PMs should ensure other action proponents are planning for NEPA actions related to their programs.

4.4. HOW SHOULD NEPA BE INTEGRATED?

4.4.1. NEPA Planning

The PESHE (as a part of the AS) or a more detailed ESH Master Plan (ESHMP) are excellent NEPA planning documents that help PMs determine when and how formal NEPA documentation should be prepared. The

Although not NEPA documents, the PESHE and the ESHMP support NEPA planning.

[25] SECNAVINST 5000.2B, Section 4.3.7.1 and its tables on pp. 8 and 9.

PESHE and the ESHMP are not NEPA documents; however, they are important parts of the Program Administrative Record File because they identify proposed actions throughout the system acquisition process that may have impacts on the human environment. As planning documents, the PESHE and the ESHMP are typically prepared before the development of formal NEPA documentation.

NEPA planning and multi-disciplined analyses typically include the proactive "partnering" with environmental regulatory agencies and certain public interest groups. When done properly, this relationship enhances DON's public image as a responsible and concerned neighbor. On the other hand, highly visible and costly publicity is often associated with NEPA non-compliance.

To ensure that a balanced, complete, and multi-disciplined NEPA analysis is conducted, PMs should leverage the available expertise within the NAVSEA community. This includes the headquarters (e.g., SEA 00D, SEA 00L, SEA 00T) and the installations, test ranges, and facilities at which the action is proposed.

4.4.2. Defining the Proposed Action

Defining the proposed action is the most critical step in the NEPA thought process. In some cases, PMs sometimes confuse the proposed action with the preferred alternative. For example, a common proposed action for PMs is the requirement to validate the design in terms of technical requirements. This could include various parameters such as reliability, lethality, survivability, top speed, and stability in various sea states. The action in this case is the validation of critical requirements. Alternatives might include conducting computer simulations, model testing, component-level testing, or full system testing.

Full system testing is one alternative to the PM's proposed action for validating system performance.

Issues surrounding this action might include *where, when, and how* to validate the performance of the system. These three issues are critical to a complete NEPA analysis. The "*where*" is an important part of the consideration because of the impact to a specific location. For instance, the same action that involves significant noise pollution (e.g., from a gun-firing validation) might be perfectly fine in a remote test range but unacceptable in proximity to a residential community or a commonly used recreational area. The "*when*" is also important: noise generated during the day might be perfectly acceptable; but the same noise levels at night (when residents are sleeping) might be unacceptable. The "*how*" is important because the generation of excessive noise levels might be mitigated to acceptable levels by various alternatives such as using reduced powder charges, erecting portable noise baffles, conducting gun firing computer simulations, or doing a component test in a sound proof chamber.

4.4.3. Identifying and Assessing the Alternatives to the Action

The PM must assess a number of alternatives to the proposed action. Based on programmatic issues (e.g., environmental impacts, cost, schedule, and performance risks), the PM should identify the preferred alternative. This alternative best meets the PMs programmatic requirements. PMs should ensure that this alternative and all other reasonable alternatives realistically consider the impact to the human environment and any necessary mitigation. In the case of proposed actions to validate system performance, the preferred alternative might be a full system test. In some cases, a preferred alternative might be the conduct of model testing. One example of this situation might be the action to initially validate sea-keeping characteristics. Although the full scale system test is an alternative, the PM might consider a full scale system test not to be the preferred alternative. The PM might conclude that there are unacceptable crew hazards in testing a system at sea without first conducting model testing. The full scale system test in this case is considered reasonable (because it will validate sea-keeping characteristics) but not preferred.

PMs should consider the impacts of their alternatives on the human environment; and PMs should support necessary mitigation.

Once the reasonable alternatives are identified, the PM should assess each one on its merits and risks.

To assist PMs, a policy memorandum[26] has been issued that defines environmental considerations in test site selections.

4.4.4. Assessing the "No Action Alternative"

NEPA requires that the PM also assess the "No Action Alternative." In the case of a system validation, this alternative would consider the impact if the validation were not conducted. Justification to rule out the "No Action Alternative" for a system validation might include undue risk to the program, insufficient data for the next milestone, violation of a public law (e.g., Live Fire Testing per Title 10 USC §2366[27]), or some other programmatic issues that raises the risk to an unacceptable level. NEPA does not require that the PM take undue risks; in fact, it supports good decisions that balance protection of the human environment with other critical parameters in the decision-making process. NEPA does not take legal precedence over substantive laws.

NEPA does not take legal precedence over substantive laws, such as those for Live Fire Testing.

[26] ASN(I&E) memorandum, Department of Navy Environmental Policy Memorandum 99-01; Requirements for Environmental Considerations in Test Site Selection, dated 11 May 1999.
[27] Title 10, United States Code, Section 2366, Major Systems and Munitions Programs: Survivability and Lethality Testing Required Before Full Scale Production.

4.4.5. Determining the Level of NEPA Analysis and Documentation

PMs should understand the levels of analyses and corresponding documentation requirements of NEPA as they apply to acquisition programs. NEPA can have significant impact on programs. PMs should avoid this impact by ensuring they complete the proper level of analysis and documentation.

NEPA documentation is only adequate when it is supported by the proactive thought process that analyzes potential environmental impacts. Required NEPA documentation simply articulates that thought process and its influence on program decisions.

Certain programs may need formal NEPA documentation and public comment and involvement. PMs should consult with SEA 00L if they have questions concerning the level of public involvement required for their proposed actions.

Formal NEPA documentation should be concise and focused on the decision or action under consideration. The Federal NEPA implementing regulations state:

> *Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork - even excellent paperwork - but to foster excellent actions. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences and take actions that protect, restore, and enhance the environment."*[28]

NEPA analysis and corresponding formal (i.e., required by law) documentation are categorized in three levels: the Categorical Exclusion (CATEX), the Environmental Assessment (EA), and the Environmental Impact Statement (EIS). Based on the proposed action (the *where*, the *when*, and the *how*), the PM determines which level of analysis and documentation applies. PMs should consult OPNAVINST 5090.1B CH-1 and SECNAVINST 5000.2B for more details on NEPA procedures, coordination requirements, and approval authority. Appendix B is used here to illustrate the logic and key issues that must be addressed. After the PM has identified and assessed the proposed action and alternatives, the first issue is whether a CATEX applies.

The three levels of NEPA analysis are the CATEX, the EA, & the EIS.

If a CATEX applies, the PM prepares, staffs, and signs a Record of Categorical Exclusion and proceeds with the action. If the action is not justified as a CATEX, then the PM proceeds to the EA.

If the EA determines that there are no significant impacts, the PM prepares, staffs, and obtains approval for a Finding Of No Significant Impact (FONSI). The EA may require public

[28] 40 CFR 1500.1(c).

involvement[29]. If the EA determines that there is a potential for significant impacts, then an EIS is required.

The EIS is a detailed study of the impacts and necessary mitigation associated with the proposed action. The PM drafts, staffs (through CNO), and obtains approval for the Record Of Decision (ROD). The EIS process requires public involvement.

4.4.6. Determining if a CATEX Applies to the Proposed Action

DON identifies CATEXs as categories of actions that have been found not to have a significant effect on the human environment individually or cumulatively, under normal circumstances, and therefore do not require further analysis or documentation. Actions can be considered for CATEX if they meet the following definition:

- they do not significantly affect the quality of the human environment,
- they do not result in any significant change from existing conditions at the site of the proposed action, and
- their effect is primarily social or economic.

Even if a proposed action generally meets the above CATEX definition, PMs may ***not*** use the CATEX justification if the action meets the following screening criteria:

- affects public health or safety;
- involves a potential significant impact on wetlands, endangered or threatened species, historical or archeological resources, or hazardous waste sites;
- involves effects on the human environment that are highly uncertain, involve unique or unknown risks, or are scientifically controversial;
- establishes precedents or makes decisions in principle for future actions with significant effects; and/or
- threatens a violation of Federal, State, or local law or requirements imposed for protection of the environment.

After the PM has determined that the proposed action meets the CATEX definition and the action does not meet the screening criteria, the PM must then determine which of the approved CATEXs[30] applies. None of the currently approved CATEXs apply to system performance validation or testing. DON is considering expanding the list of CATEXs. PMs should check the latest approved list.

None of the currently approved CATEXs apply to system performance validation or testing.

[29] OPNAVINST 5090.1B, CH 1, p. 2-10.

[30] The currently approved list of CATEXs can be found in OPNAVINST 5090.1B CH-1 p. 2-6, paragraph 2-4.2.

Based on these criteria, PMs are at risk of violating DON's NEPA procedures by incorrectly applying CATEXs to system performance validation or testing. If, however, the PM still believes the proposed action qualifies as a CATEX, the PM must prepare a Record of Categorical Exclusion. This documents the decision not to prepare an EA or EIS based on one or more CATEXs. The PM must describe the facts supporting the use of a CATEX and the specific considerations of how the proposed action meets the definition and screening criteria. After the Record of Categorical Exclusion has been staffed and signed, the PM may proceed with the proposed action.

Records of Categorical Exclusion need not be more than one or two pages[31]. PMs can anticipate from one week to two months to prepare, staff, and sign a Record of Categorical Exclusion.[32]

CATEXs need not be more than one or two pages.

4.4.7. Preparing an EA for the Proposed Action

If the proposed action does not qualify for a CATEX, the PM should then determine if an EA is appropriate. The EA is a concise public document that determines if an EIS is required (i.e., the EA determines if the action has the potential for significant impact).

The EA determines if the proposed action will result in significant impacts.

If the EA determines that the proposed action has no significant impact on the human environment, the PM prepares, staffs, and obtains approval for the FONSI. The PM may then proceed with the proposed action.

If the EA determines that significant impacts may occur, the PM prepares an EIS. The PM may skip the EA and proceed directly to the EIS. Skipping the EA is done when the PM has already determined that the proposed action has the potential for a significant impact.

The EA should briefly include the following:

- discuss the need for the action,
- discuss the alternatives considered,
- describe the environmental impacts,
- describe any environmental monitoring requirements, and
- list the agencies and persons consulted.

The EA process (including the preparation of the EA and staffing of the FONSI) can take from six to eight months. The President's Council on Environmental Quality (CEQ) has

[31] OPNAVINST 5090.1B CH-1, p. 2-6, paragraph 2-4.1.
[32] SECNAVINST 5000.2B, Section 4.3.7.1 and its table on p. 8.

cautioned agencies to avoid lengthy EAs and indicated that EAs can be as short as ten to fifteen pages[33]. Some NAVSEA EAs are much longer than this suggested length.

EAs can be from ten to fifteen pages.

4.4.8. Preparing an EIS for the Proposed Action

The EIS is the most complicated and detailed NEPA analysis. In an EIS, the PM provides full and unbiased discussion and analysis of significant impacts and informs the public of the reasonable alternatives that would avoid or minimize adverse impact or enhance the quality of the human environment.

In meeting NEPA's goal to make informed decisions and to prepare concise and useful documents, PMs should:

- prepare analytic rather than encyclopedic EISs,
- include discussions of impacts in proportion to their significance,
- keep EISs concise (no longer than necessary for NEPA compliance),
- include a description of the criteria for selecting alternatives,
- encompass the appropriate range of alternatives,
- not make irreversible commitments of resources that change the environment before a final NEPA-supported decision,
- use EIS as a means of assessing whether environmental impacts of proposed actions have disproportionately high adverse human health or environmental effects on minority and low-income populations[34], and
- satisfy the General Conformity Rule.[35]

The EIS may follow the format shown in Figure 4.1. After an EIS is prepared, a ROD is drafted by the PM, staffed by CNO, and signed by ASN(RDA). After coordination, the ROD may be available to the public.

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[33] The CEQ answers to questions 36a & 36b from the "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" printed in the Federal Register Vol. 46, No. 55, 18026-18038, dated 23 March 1981.

[34] Compliance with E.O. 12898, Environmental Justice, dated 11 February 1994.

[35] Must be included for actions in Air Quality Management Districts (AQMDs) designated as "maintenance" or "non-attainment."

COVER SHEET

SUMMARY

PURPOSE OF AND NEED

ALTERNATIVES INCLUDING THE PROPOSED ACTION

EXISTING ENVIRONMENT OF THE PROPOSED ACTION

ENVIRONMENTAL CONSEQUENCES

LIST OF PREPARERS

APPENDIX

INCORPORATION BY REFERENCE

INCOMPLETE OR UNAVAILABLE INFORMATION

FIGURE 4.1 RECOMMENDED EIS FORMAT
(Source: OPNAVINST 5090.1B CH-1)

Normally, EISs are not more than 150 pages.

The EIS process (includes preparation of the EIS and staffing of the ROD) can take from fourteen to twenty-two months. The text of the EIS should normally be less than 150 pages. The text for unusually complex EISs should normally be no more than 300 pages.[36] Some NAVSEA EISs are much longer than this suggested length.

4.4.9. Actions Not Requiring NEPA

Contractor actions (when not influenced by the PM) are not subject to NEPA.

NEPA applies to decisions and actions made by federal agencies. Within this context, compliance with NEPA is not required for actions that are made outside of the influence of the PM. The site selection, construction, and operation of a manufacturing facility by a contractor are not subject to NEPA, assuming that the government has not specified the site location, construction, or operations of the contractor's facility. In this case, the contractor (and not the PM) is making the decisions.

Although NEPA may not apply to a specific contract, the PM should ensure the contractor is required to comply with all applicable laws and regulations.

Although this example is not subject to NEPA, the PM should ensure that if there is a production contract, the contract stipulates that

[36] OPNAVINST 5090.1B CH-1, page 2-15 paragraph 2-4.4.5.

the contractor shall be in full compliance with all applicable federal, state, and local ESH laws and regulations. Compliance with ESH laws and regulations is addressed in Section 5 of this guide.

4.4.10. Actions Outside the United States

Proponents of proposed actions having the potential for significant effects on the environment outside the geographical borders of the United States, its territories, and possessions must also take environmental considerations into account per E.O. 12114 and DODD 6050.7. Appendix E of OPNAVINST 5090.1B, Change 1, presents procedures to follow when a proposed Navy action affects the environment outside the jurisdiction of the United States. Recently, the territorial waters for the United States have been extended from twelve nautical miles to twenty-four nautical miles. In this case, NEPA applies to actions within the territorial waters limit, and the E.O. 12114 applies to actions outside of this limit.

4.5. WHEN SHOULD NEPA BE INTEGRATED?

CE is typically the first time that PMs need to plan for NEPA compliance.

Typically, PMs will first need to plan for NEPA during Concept Exploration (CE) (e.g., DT-0, AOA). Any follow-on actions will also be subject to NEPA. Recent weapon system test programs have been adversely impacted because PMs did not fully consider the impact of the action on the environment, did not appreciate the sensitivity of the action to the surrounding community, or did not sufficiently consider all the reasonable alternatives. In the case of DT, PMs should work closely with their test support organizations, legal counsel, and environmental specialists to ensure potential environmental impacts and necessary mitigation are addressed *before* the testing begins. The best time to address these issues is during the preparation and updating of the Test and Evaluation Master Plan (TEMP). Actions subject to NEPA may also be initially addressed in the PESHE or the ESHMP.

NEPA planning should also be integrated into the PM's Program Objective Memorandum (POM)-building process to ensure adequate funding is available when it is needed to support the NEPA analysis, documentation, and mitigation (as applicable).

As action proponents, PMs are responsible for ensuring sufficient time is included in the DT schedule for the preparation and staffing of NEPA analysis and documentation. Also, PMs should plan sufficient time and resources for any necessary mitigation associated with proposed actions.

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SECTION 5. ESH COMPLIANCE[37]

5.1. WHAT IS ESH COMPLIANCE?

ESH Compliance includes the identification and integration of ESH regulations and the constraints they impose on program execution to minimize cost and schedule risks of these changing requirements. OPNAVINST 5090.1B CH-1 (Appendix A)[38] provides a synopsis of pertinent Environmental Laws, Executive Orders, Regulations, and Directives. DON policy requires compliance with all environmental laws and regulations and makes Federal Occupational Safety and Health Act regulations applicable to all federal employees working in military and non-military-unique DOD operations and workplaces, regardless of whether work is performed by military or civilian personnel. In the case of military-unique equipment, systems, operations, or workplaces, federal safety and health standards, in whole or in part, apply to the maximum extent practicable. OPNAVINST 5100.23E[39] and OPNAVINST 5100.19C[40] provide a synopsis of pertinent OSH Laws, Executive Orders, Regulations, and Directives. Other key ESH policies include DODD 6050.7, E.O. 12196[41], and DODI 6055.1.[42]

5.2. WHY INTEGRATE ESH COMPLIANCE?

ESH compliance impacts on Life Cycle Costs can range from 18% to 30% of the total program cost.

The DOD Inspector General (DODIG) has claimed that the ESH compliance impacts on LCC can range from 18% to 30% of the total program cost.[43] Even if this claim is off by an order of magnitude, the cost for ESH compliance of a typical major system can involve billions of dollars.

Integration of ESH compliance issues into the systems engineering process provides input to minimize life cycle impacts through design of the system. Design-related ESH compliance considerations include: hazardous materials selection, noise emissions, multi-media discharges, personnel exposure to toxic chemicals and by-products, and damage/loss of equipment and injury/death of personnel from system safety hazards. Without ESH compliance input to the systems engineering process, design engineers and logisticians may make decisions that may have significant unforeseen adverse impacts on ESH compliance. When ESH compliance is not effectively integrated into the systems engineering process, systems are fielded that necessitate the operating and maintenance installations to make costly investments in compliance

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[37] Current acquisition policies only require "Environmental Compliance." NAVSEA has expanded this section to include "Safety & Health" compliance because in most cases E, S, & H compliance issues are inter-related and in some cases inseparable.
[38] Has not been updated to reflect Uniform National Discharge Standard (UNDS).
[39] OPNAVINST 5100.23E, Navy Occupational Safety and Health Program Manual, dated 15 January 1999.
[40] OPNAVINST 5100.19C, Navy Occupational Safety and Health Program Manual for Forces Afloat, dated 19 January 1994.
[41] E.O. 12196, Occupational Safety and Health Programs for Federal Employees, dated 26 February 1980.
[42] DODI 6055.1, DOD Occupational Safety and Health Program (Changes 1 & 2), dated 26 October 1984.
[43] DODIG Audit Report on Financial Management of the RAH-66 Comanche Helicopter Program (Report No. 98-185), dated 6 August 1998, p. 14.

technologies, such as paint scrubbers, high temperature incineration, waste water treatment plants, noise abatement devices, and personal protection devices. None of these compliance technologies add value to the system; in fact, they have negative value because they require resources for installation as well as for recurring maintenance.

By integrating ESH compliance issues into the systems engineering process, PMs can reduce the DON's liability associated with ESH compliance over the life cycle of the system. Systems that are designed with ESH compliance in mind will reduce operational liabilities and risks.

By conducting ESH compliance analyses that identify future ESH compliance problems of the system, PMs will be in a better position to influence the selection of materials and other design-related characteristics. Design-related characteristics, such as reducing noise levels, can increase the capability of the system to operate efficiently with minimal impacts from environmental regulators and can improve occupational health and safety.

When PMs effectively integrate the results of their ESH compliance analysis into the systems engineering process, the resulting design is usually more cost effective and less likely to be impacted by Notices Of Violation (NOVs) for non-compliance. The ASN(RDA) addressed this issue by stating: "I am committed to fielding weapon systems that meet the operational requirements of the fleet while minimizing environmental restrictions on training, exercises, and routine operations. I believe this to be a realistic goal if we embed the concept of environmental consideration early in the acquisition process." [44]

Program reviews (e.g., program milestone reviews) often include an MDA review of the PM's planned ESH compliance issues for the next phase. Some advisory boards, such as the Weapon System Explosives Safety Review Board (WSESRB), now require PMs to address ESH compliance status during their program reviews.

PMs are now required to address the impacts of the operational use of the system and status of any tradeoff analyses at each milestone program decision brief.[45]

PMs are required to address the impacts of operational use of the system at milestone reviews.

5.3. WHO SHOULD INTEGRATE ESH COMPLIANCE?

Only fifty-six percent of the Navy programs surveyed by the Defense Systems Management College (DSMC) reported that they integrate environmental concerns.[46] DOD Regulation 5000.2-R now clarifies that PMs are responsible for ESH integration into the systems engineering process that supports their program.

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[44] ASN(RDA) memorandum, dated 13 January 1998.
[45] ASN(RDA) memorandum, dated 13 January 1998.
[46] Defense Systems Management College Technical Report, TR-1-95, entitled: "Environmental Practice in Program Management Offices," dated January 1995; Table 4-3.

PMs, working closely with their field installations and operational users (e.g., test ranges, operational bases, fleet commanders, and maintenance facilities), should integrate ESH compliance considerations into the systems engineering process.

5.4. HOW SHOULD ESH COMPLIANCE BE INTEGRATED?

PMs can effectively integrate ESH compliance considerations into the systems engineering process by establishing and using a baseline database of current ESH compliance cost drivers as input. This effort can be described in the following four steps:

- Establish an ESH compliance database associated with the current Afloat and Ashore ESH compliance cost drivers.
- Determine if the design of the new system perpetuates the current ESH compliance cost drivers.
- If these ESH cost drivers are in (or planned for) the design of the new system, prioritize their importance.
- Provide this information as input to the Safety Program (SP) (formally the System Safety Plan), the Hazardous Materials Management Program (HMMP), and the Pollution Prevention Program (PPP) for tradeoff analyses.

This four-step process will help PMs meet the ASN(RDA) requirement: "To ensure the milestone decision authority is apprised of all aspects of the program, effective immediately, the environmental portion of each milestone program decision brief shall address the mandatory environmental evaluation, including the impacts of the operational use of the system and the status of any tradeoff analyses or other actions taken in conjunction with the operational or requirements communities." [47]

The VIRGINIA Class Submarine Program has successfully used a similar baseline approach. The PM used the lessons learned from the Puget Sound Naval Shipyard's (PSNS) experiences in disposing of current nuclear submarines. The information gathered from PSNS was used as input to the "design for disposal" concept. This effort is a classic example of how baselining current ESH cost drivers can be used in the design of new systems or even modifications to existing systems. The PM has consistently won the annual SECNAV and OSD Pollution Prevention Awards because of this type of effective management technique.

[47] ASN(RDA) memorandum, dated 13 January 1998

5.4.1. Establish an ESH Compliance Database Associated with Current Cost Drivers

PMs can effectively integrate ESH compliance issues by first establishing a database of current ESH cost drivers.

In most cases, ship and ship-related acquisition programs involve improving an existing system or developing a new system to replace an existing system. PMs can use the existing system that will be modified or replaced as the baseline from which current fleet ESH issues can be identified. These current ESH issues become the initial input for the PM's ESH compliance database. This database can be established through coordination with the operational and maintenance personnel. Identifying current ESH drivers is relatively simple, but in some cases root cause issues might inadvertently become "masked." For example, because the operators and maintainers have had to rely on "end-of-pipe" technologies for so long, they may view the cost of compliance as just a routine "cost of doing business." A classic example is the use of paint scrubbers to maintain compliance with Clean Air Act (CAA) and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. The personnel at the shore installation might never identify the costs of handling, treating, and disposing of high Volatile Organic Compound (VOC) paints as a driver because they might assume that the paint they use cannot be changed. Rather than ask a general question, such as, "What are your ESH compliance drivers?" PMs should ask, "Would a reformulated paint that met CAA/NESHAP requirements save you money?"

To establish the ESH compliance cost drivers with the baseline system, PMs should contact those Afloat and Ashore activities that have tested, operated, and maintained that specific (or a similar) system. ESH compliance issues usually involve the use of materials, industrial processes, and components that drive ESH compliance costs. Any significant ESH compliance problems with the baseline system are usually well documented and understood by the Afloat operational/maintenance personnel and the Ashore maintenance personnel. PMs should also inquire if they know of any up-coming local or state laws that may impact their activity in the near future. To ensure that they have early input from applicable Afloat and Ashore communities concerning ESH compliance cost drivers, PMs may invite these representatives to be members of the ESH Working Group (ESHWG). The ASN(RDA) requires[48] that PMs must "…ensure that all stakeholders (specifically representatives from the requirements and operational communities) are invited to participate on all acquisition coordination teams as well as appropriate functional teams."

While most ESH compliance data is available within DON, PMs should also consider emerging data from outside sources.

Although much of the information needed by the PM to develop the ESH compliance database exists within the DON, PMs are advised to also consider outside sources, particularly for emerging ESH compliance cost drivers. One such example of a health cost driver is the recently publicized federal production facility that has used beryllium for a number of years. There were no environmental compliance issues with the use of beryllium, but because of health concerns,

[48] ASN(RDA) memorandum, dated 13 January 1998.

the agency established a Chronic Beryllium Disease Prevention Program[49]. The agency has recently allocated $5 million[50] for this issue. This cost included only the health screening of 5,000 former plant employees. Costs associated with treatment, compensation, and legal liabilities have not yet been identified.

5.4.2. Determine if Proposed System Perpetuates Current ESH Compliance Cost Drivers

After current Afloat and Ashore ESH compliance cost drivers are identified, the PM should determine if the design of the new system includes (or will include) materials, industrial processes, or components that will perpetuate these fleet problems. This usually involves asking the system design engineers and logisticians if they intend to use these materials, industrial processes, or components.

PMs should determine if their proposed systems will perpetuate current ESH compliance problems.

If these materials, industrial processes, or components are planned for the PM's system, the PM should first challenge their use by asking if alternatives have been considered that would mitigate the ESH compliance impact. This is an important step for the PM because uninformed systems engineers, designers, and logisticians will tend to use the same materials, industrial processes, and components that they have used for previous systems. This is quite normal because they know and understand the technical performance of these older technologies and processes, and they may tend not to want to change or deviate from these concepts. In many cases, these predecessor systems were developed and fielded before many ESH laws were passed. PMs should remember that their goal is not to eliminate all ESH impacts or risks, but rather make informed decisions that meet operational performance while protecting humans and the environment at the lowest possible Total Operating Cost (TOC) to the DON over the life cycle of their system. An informed decision is made when the PM has ensured adequate analysis of these considerations is made in the final selection of the materials, industrial processes, or components. For instance, selecting a known hazardous material that meets program cost, schedule, and performance requirements and provides the least TOC impact to the DON over the life cycle of the system is an acceptable informed decision.

5.4.3. Prioritize Importance of Identified ESH Compliance Cost Drivers

After the PM has identified that ESH Compliance cost drivers are planned for the new system, the PM should prioritize their importance. The prioritization can be based on many parameters, but two core issues to consider are the magnitude of the cost driver and the ease/difficulty to eliminate (or even mitigate) the cost driver. Prioritizing the ESH compliance cost drivers will help the PM make better decisions to either invest in eliminating them or accepting the impacts to TOC. To assist in this area, ASN(RDA) has promulgated ESH goals

[49] 10 CFR Part 850 Chronic Beryllium Disease Prevention Program, Federal Register/Vol. 63, No. 232/Proposed Rules, dated 3 December 1998.
[50] DOE Events and Activities web site, Health Screening Program for Former Workers.

and has endorsed the team work among the acquisition, operational, and requirements communities[51].

5.4.4. Input Identified ESH Compliance Cost Drivers into other ESH-related Programs

The prioritized listing of ESH compliance issues then becomes input to the SP, the HMMP, and the PPP.

5.5. WHEN SHOULD ESH COMPLIANCE BE INTEGRATED?

PMs should establish their ESH compliance database early in the systems engineering process when material, industrial process, and operational concepts are first proposed. Initiating the ESH compliance database during the CE Phase usually provides a sound foundation for effective and early input into the Program Definition and Risk Reduction (PDRR) Phase prototype design trade studies.

[51] ASN(RDA) memorandum, Logistically Relevant Environmental and Occupational Safety and Health (ESH) Goals for Weapons Systems Acquisition, dated 24 May 1999.

SECTION 6. SAFETY AND HEALTH

6.1. WHAT IS SAFETY AND HEALTH?

Safety and health considerations are an integral part of the Navy's total safety and occupational health program[52]. System safety is defined[53] as the application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle. System safety also includes the health-related issues associated with design of the system[54]. To reinforce the concept that system safety includes all aspects of safety, the title of this effort has been expanded from "System Safety and Health" to "Safety and Health."

The mandatory requirements[55] for safety and health considerations focus on identifying and evaluating hazards; determining risk levels; and establishing a program to manage the probability and severity of all hazards associated with the development, use, and disposal of the system. Each management decision to accept risks associated with an identified hazard shall be formally documented. The ASN(RDA) shall be the final approval authority for acceptance of high risk hazards; and acceptance of serious risks may be approved at the Program Executive Officer (PEO) level for PEO managed systems or by the Commander, Naval Sea Systems Command for all other programs.

Federal Occupational Safety and Health Act regulations apply to all Federal employees working in non-military-unique DOD operations and workplaces, regardless of whether work is performed by military or civilian personnel. Health hazards are typically associated with exposure to chemicals, materials, and processes. From manufacturing and maintenance perspectives, there may be additional health hazards generated as these chemicals and materials are handled (e.g., machining, sanding). From an operational perspective, these chemicals and materials may pose additional health hazards as they are heated (e.g., off-gases) or burned (e.g., pyrolysis products). Another aspect of health hazards includes induced stress from various loads (e.g., electrical shock, vibration/mechanical shock, cold/heat shock) imposed by the operation/maintenance of the system.

6.2. WHY INTEGRATE SAFETY AND HEALTH?

6.2.1. DOD Recognizes the Need for an Aggressive Safety and Health Program

System and health considerations have become much more of an issue as the DON force structure is reduced and the unit cost of each system increases. Accidental equipment damage/loss and personnel injury/deaths are major TOC drivers. The Under Secretary of Defense (Acquisition and Technology) (USD(A&T)) issued a memorandum[56] that reinforced his

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[52] OPNAVINST 5100.19C, paragraph A0101.
[53] MIL-STD-882C, p. 6.
[54] MIL-STD-882C, includes Task 207 "Health Hazard Assessment".
[55] DOD Regulation 5000.2R, Section 4.3.7.3.
[56] USD(A&T) Memorandum, subject: "System Safety and MilSpec Reform," dated 11 August 1997.

belief that the effective implementation of system safety leads to "…safer designs at lower cost…." To clarify the importance of system safety he further stated: "Some individuals have construed our new acquisition philosophy to indicate the Department has slacked off on systems safety. Quite the contrary. DOD 5000.2-R…requires program managers to have an aggressive system safety program, and to continually work with their contractors to identify and mitigate design-induced safety risks."

DOD requires that PMs have an aggressive system safety and health program.

Chemicals, materials, and processes associated with systems can introduce health hazards. Unless PMs properly assess these health hazards, PMs may unknowingly adversely impact TOC. Health-related TOC drivers can include issues associated with requirements for workplace monitoring, medical surveillance, personal protective equipment, hazardous waste disposal, as well as potential for future liability for the DON in areas pertaining to exposures of workers to chemicals and materials associated with the life cycle of weapon systems.

Program reviews (e.g., program milestone reviews) often include MDA review of the PM's planned Safety and Health issues for the next phase. Some advisory boards, such as the Weapon System Explosives Safety Review Board (WSESRB) now require PMs to address Safety and Health status during their program reviews.

6.2.2. An Effective Safety and Health Program saves Lives and Equipment

By effectively incorporating safety and health considerations into the design process, PMs can provide safer and more effective systems. Integrating safety and health issues into planning, engineering, and acquisition is one of the five major strategies within the Navy Occupational Safety and Health Strategic Plan[57]. Navy Afloat on-duty fatalities in non-aviation accidents have shown a downward trend. Based on a General Accounting Office (GAO) report[58] covering 1988 through 1996, approximately 70% of all fatalities were systems related (e.g., explosion, boat capsizing, fire/steam, equipment, electrocution, maintenance/repair, and weapon). During this period, three accidents accounted for almost 50% of the fatalities. Because only a few system-related accidents can account for extensive loss of life, all PMs must properly integrate safety and health issues. As a verification of the relationship between the level of safety in the design and system losses, recent aircraft accident investigations within DOD have indicated that losses have been due to the lack of a consistent and disciplined engineering process.[59]

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[57] Navy Occupational Safety and Health Program FY 1997 Agency Annual OSHA Report.
[58] GAO Report to the Secretary of Defense, Military Safety - Analysis of DOD's On-duty Non-aviation Accident Fatalities, (Report Number GAO/NSIAD-99-14), dated October 1998.
[59] Air Force Materiel Command memorandum, Operational Safety, Suitability and Effectiveness (OSS&E) Policy, dated 15 January 1999.

6.2.3. An Effective Safety and Health Program Builds Confidence in Operational Effectiveness of the System

When safety and health considerations are effectively integrated into the overall design of the system or product through the systems engineering process, the system tends to be more combat effective because of fewer accidental personnel and equipment losses. In addition, operators and maintainers of combat equipment will be more effective (both in peacetime and in combat) if they have confidence that the systems and products they use pose no undue safety or health risks. This morale issue has been a significant force multiplier in recent conflicts. PMs should ensure the operators and maintainers are part of the ESH decision-making process. PMs should invite them to become members of their Integrated Product Team (IPT). ASN(RDA) has issued guidance[60] directing PMs to ensure all stakeholders (specifically representatives of the requirements and operational communities) are invited on all acquisition coordination teams (ACTs), as well as appropriate functional teams.

Integrating safety and health considerations results in systems that are more combat effective; plus, operators and maintainers will have more confidence in the system.

6.2.5. Safety and Health Management Techniques Support ESH Risk Management

The proven management concepts contained within MIL-STD-882C support effective ESH risk management. The management concepts are simple but effective. They seek to manage hazards by assessing the probability of an occurrence and the severity of that occurrence if it happens. By identifying and assessing ESH hazards, PMs can implement mitigation through the design of the system to acceptable levels. A key safety and health management technique is the establishment of a risk mitigation hierarchy. Similar to the pollution prevention hierarchy (see Figure 8.1), this concept seeks to first eliminate the hazard from the design. After this, other actions that reduce the hazard are considered in descending order of effectiveness. Figure 6.1 lists a typical hazard-mitigation hierarchy.

ELIMINATE THE HAZARD THROUGH DESIGN CONSIDERATIONS.

REDUCE THE HAZARD TO AN ACCEPTABLE LEVEL THROUGH DESIGN CONSIDERATIONS.

REDUCE THE HAZARD TO AN ACCEPTABLE LEVEL THROUGH EXTERNAL DEVICES.

REDUCE THE HAZARD TO AN ACCEPTABLE LEVEL THROUGH WARNING DEVICES.

REDUCE THE HAZARD TO AN ACCEPTABLE LEVEL THROUGH PROCEDURES & TRAINING.

FIGURE 6.1 Typical Hazard Mitigation Hierarchy

[60] ASN(RDA) memorandum, dated 13 January 1998.

This hierarchy provides the PM with a logical prioritization of hazard mitigation alternatives. Eliminating the hazard by "designing out" the hazard should always be the first choice. If it is not selected, then the PM should consider at least reducing the hazard through some design feature. If neither of these is selected, then external devices should be considered. Only as a last resort should simply installing warning devices and establishing procedures and training be considered as stand-alone alternatives. If a hazard cannot be eliminated, then a combination of all of the remaining alternatives should be considered.

Eliminating hazards through design considerations is always the best mitigation alternative.

For example, take the situation of flammable fluids (e.g. lube oils, hydraulic fluids, fuels) in a normally occupied compartment. The hazard in this case involves burns to personnel and exposure to pyrolysis products. The first alternative is to eliminate the flammables from the compartment, either by re-routing lines or relocating the equipment that uses the fluids. If this is not selected, using less flammable liquids and/or designing lines that will self-seal if ruptured might be design considerations to reduce the hazard. An external device to reduce the hazard might be the installation of an automatic fire detection and extinguishing system using thermal and optical sensors and a suppressant that is safe and effective. This last alternative does not reduce the root cause of the hazard (i.e., the fire); it merely reduces the hazard in terms of severity if a fire should occur. Warning devices might include posting warning placards at high risk components such as duplex strainers or valves. Lastly, the PM should consider including fire fighting procedures in the ship's standard operating procedures and establish fire fighting training for personnel assigned to the compartment and the damage control party.

If the PM could not select the first alternative, then ***all of the other alternatives*** should be considered as a group to reduce the hazard to an acceptable level.

If eliminating the hazard is not selected, a combination of the other mitigation alternatives should be considered to reduce the hazard.

6.3. WHO SHOULD INTEGRATE SAFETY AND HEALTH?

6.3.1. PMs are Key to Integrating Safety and Health

The PM is responsible for implementing a system safety and health program. In most cases, the PM's contractor will conduct the systems engineering trade studies for developing the design. PMs should ensure their contractors understand how to integrate system safety and health considerations into the earliest phases of the design. Figure 6.2 provides advice for PMs in executing this responsibility. PMs may elect to use the services of the Navy Environmental Health Center in conducting independent health-related assessments.

DOD Regulation 5000.2 -R identifies the Component Acquisition Executive (CAE) as the final approval authority for acceptance of high risk hazards and the PEO level for acceptance of serious risks hazards. For joint programs/projects, all participants shall approve acceptance of high risk hazards.

You, the Program Manager (PM), should be aware that the issue of safety creates several conflicting incentives for contractors. Naturally, contractors have an incentive to avoid serious, flagrant hazards that may jeopardize the ultimate future of the program or cause them to incur liability for subsequent accidents. However, through the Engineering Change Proposal (ECP) process, contractors generally benefit from hazards allowed to creep into designs. ECPs are major profit centers. The most difficult ECPs for a PM to disapprove are those flagged "Safety." And if safety problems are allowed to be created and remain undetected until late in development, the fixes can wreak havoc with your budgets and schedules.

You acquire acceptably safe systems through a three-step process. First, you need to prevent the initial creation of unnecessary hazards. You do this by communicating to the developer that safety is IMPORTANT to you personally. Insist they design it in, not add it on. Direct the developer (contractor) to sensitize design engineers to be attentive to system hazards while creating the design, so they may minimize the number and severity of hazards initially residing in the system. This first step has historically proven to be a significant cost and problem avoidance technique -- one usually overlooked by PMs.

Next, carefully tailor a system safety activity to meet specific program needs. NOTE: If you omit the above first step, you will need a larger system safety effort to address the greater number and variety of hazards that will populate the design.

Lastly, you need to manage residual hazards. You can do this by understanding their nature and impact, and assuring they are properly dispositioned. For hazards that are to be "accepted," take care to assure that this acceptance of risk occurs at the proper level of authority -- generally the greater the risk, the higher the approval level needed for acceptance. Note that the higher level risks must be justified to the decision makers, not the Safety community.

FIGURE 6.2 Special Advice For The Program Manager[61]

6.3.2. Typical Planning Questions

MDAs, PMs, and systems engineers should review key Safety and Health planning questions.

Figure 6.3 contains questions that the MDA might consider at milestone reviews. Figure 6.4 contains questions that the PM can use to assist in planning Safety and Health considerations. Figure 6.5 contains questions that systems engineers can use in implementing Safety and Health considerations. Further safety analysis is needed if the answer to any of the first ten questions is "yes."

[61] From MIL-STD-882C, p. A-1.

1. **What are the safety and health hazards of this technology, if any, and how do they compare to current system(s)? What existing OSH issues does the new technology minimize or remove?**

2. **What are the training requirements of this new technology that specifically address safe operation and maintenance?**

3. **What process or mechanism has your program used to integrate Safety into all decision making; including, for example, human factors, survivability, reliability, maintainability, and interoperability of the proposed system?**

4. **What specific tests have been conducted to verify or validate safe performance, maintenance, storage, and disposal of the proposed system and its components?**

FIGURE 6.3 Key Safety and Health Management Questions for the MDA.

1. **How have you established, planned, organized, implemented, and maintained an effective system safety effort that is integrated into all life-cycle phases?**

2. **How is your system safety plan documented and updated to provide all program participants with visibility into how the system safety effort is to be conducted?**

3. **Have you established a Systems Safety Principal to assist you in developing and implementing your systems safety effort?**

4. **Does your plan assure that all types of hazards are identified, evaluated, and mitigated to a level compliant with acquisition management policy and applicable requirements?**

5. **Have definitive safety requirements for the procurement, development, and sustainment of the system been established and incorporated into appropriate system specifications, milestone documents, and contracts? Have all partners, including industry, been evaluated for ability to accomplish these requirements?**

6. **Do you provide historical safety data and technical data on Government-furnished Equipment (GFE) and Government-furnished Property (GFP) to enable the developer to accomplish the defined tasks; and do you have equivalent COTS data?**

FIGURE 6.4 Key Safety and Health Planning Questions for PMs.

1. **Is this technology being introduced to address or alleviate a current safety or health hazard? If so, what and how?**

2. **Does this technology contain or require any hazardous materials? If so, what? How are they handled? What alternatives have been researched? If there are no alternatives, what mechanism is in place to alleviate exposure?**

3. **Is there a likelihood that operators, maintainers, or supporters of this technology will be exposed to hazardous conditions? What engineering controls would prevent this?**

4. **Are there potential risks of frequent errors, acute or chronic illness, disability, injury, repetitive stress, or death with this technology? Can they be engineered out at conception? If not, how will protection limits be factored in (e.g., administrative controls)?**

5. **Does this technology require human performance in hazardous or extreme environmental conditions? If so, can the technology be operated remotely?**

6. **Are there safety and health hazards different with this technology as compared to current system(s)? Does the new technology create a new hazard? Does the new technology minimize or remove a current OSH issue or add one?**

7. **Does the proposed system display human factors, survivability, reliability, or maintainability deficiencies of such a magnitude as to become a safety deficiency?**

8. **Are there training requirements for this new technology to ensure safe operation/use?**

9. **Are there safety interface deficiencies or safety design deficiencies inherent in the current system which have also been incorporated into this system?**

10. **Do the COTS elements of the system include a documented safety review and or risk analysis, and do any of the above questions apply?**

11. **Have safety design requirements been documented and addressed?**

FIGURE 6.5 Key Safety and Health Implementing Questions for Systems Engineers.

6.4. HOW SHOULD SAFETY AND HEALTH BE INTEGRATED?

6.4.1. Establish an ESH Working Group (ESHWG)

Recently, PMs have recognized the importance of integrating ESH hazards. In many cases, these hazards are inter-related and must be addressed together rather than separately. One way to integrate the management of ESH hazards is to form an ESHWG. While MIL-STD-882C and OD44942 address the need for a System Safety Working Group (SSWG), some proactive PMs have taken the initiative to expand the responsibility and authority of this working group to include environmental and also occupational safety and health hazards. PMs should ensure that the ESHWG is staffed with knowledgeable experts who understand the program, including how the weapon system will be operated, maintained, and disposed. The alternative is for the PM to establish separate working groups for environmental, safety, *and* health risks. This tends to have at least three significant drawbacks:

PMs should establish an ESHWG to effectively address & balance ESH issues.

- having three WGs is burdensome for an already lean PM staff (three sets of meetings rather than one in the case of the ESHWG);
- having three WGs tends to duplicate those areas that overlap, something PMs cannot afford in times of minimal staffing and compressed delivery schedules; and
- perhaps most importantly, having separate WGs increases the chances for mitigation actions that at best might be redundant or at worst off-setting or conflicting, something PMs cannot afford in times of limited financial resources.

The ESHWG is chartered by the PM and contains experts in the environment, safety (includes system safety, occupational safety, and other applicable safety areas), and health fields. Membership can include representatives from the program office, representatives from headquarters, consultants, the prime contractor and representatives from other agencies as needed. PMs should ensure a balanced membership so that environmental, safety, and health issues receive equal and appropriate attention. The ESHWG is the PM's advisory board for identifying, assessing, and ranking ESH hazards. The ESHWG may also provide expert assistance to the systems engineers who will correct the design of the system to acceptable levels of risk. PMs should consider members who have Occupational Safety and Health experience to ensure the system safety program adequately addresses this area. PMs may consider including personnel from the Navy Environmental Health Center.

6.4.2. Ensure ESH Hazards and Their Mitigation are Integrated into Other ESH Areas.

NEPA is a classic example of where a PM can effectively mitigate ESH hazards by using an ESHWG. As the proponent for actions under NEPA (e.g., DT), PMs identify and fund mitigation measures that may lessen the impact to the environment from these actions. PMs who have effectively integrated ESH hazards can leverage system safety mitigation measures that will

also mitigate impact on the environment. Traditionally, PMs have not taken "credit" for such mitigation.

6.4.3. Use the DON and Industry Supported Standards

Industry has also recognized the importance of effective integration of safety and health considerations. In order to continue to protect users of military equipment, the Electronics Industries Association (EIA) issued a letter[62] to the DOD that reinforced the importance of retaining the MIL-STD-882C used to integrate system safety and health considerations into the systems engineering process. DON has exempted PMs from having to a obtain a waiver to use MIL-STD-882C. This means that PMs can specify this MIL-STD in their contracts. This exemption is good through 7 August 2001.

PMs should use MIL-STD-882C to manage ESH hazards and risks.

In addition, the DON has issued OD44942 to assist PMs and their staffs in implementing this MIL-STD-882C. PMs should review the contents of both MIL-STD-882C and OD44942 to ensure they are effectively tailoring the tasks described in these documents.

OD44942 expands and helps focus the MIL-STD requirements. OD44942 also helps PMs understand and recognize the importance of related organizations and documents. For instance, OD44942 explains the DON requirements for the WSESRB.

Both documents explain a simple and effective methodology to identify, analyze, and mitigate the ESH hazards. The methodology balances the probability of a hazard occurring versus the severity of that hazard. The severity definitions found in both documents include hazards related to safety (e.g., injury/damage of personnel/equipment), health (e.g., occupational health), and the environment (damage to the environment).

Health Hazard Assessments are included in this methodology[63]. Health Hazard Assessments identify health hazards; evaluate proposed hazardous chemicals, materials and processes; and propose protective measures to reduce the associated risk. PMs should include the requirement to conduct Health Hazard Assessments in their contracts. MIL-STD-882C provides a detailed task description for PMs to use when including this requirement in their contracts.

When a PM introduces chemicals, materials, and processes into DON for the first time, the PM should conduct a Toxicological Profile that assesses the anticipated human exposures over the life cycle of the system. PMs may consider requesting this type of health-related analytical support from the Navy Environmental Health Center.

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[62] Electronics Industries Association letter to the Director of Acquisition & Procurement recommending the retention of MIL-STD-882C, dated 10 July 1996.
[63] MIL-STD-882C, p. 207-1.

6.4.4. Sources of ESH Hazards.

Hazards to people, to equipment, and to the environment can take many forms. Hazards tend to fall into two categories: physical hazards and chemical hazards. Generally, physical hazards tend to be manifestations of uncontrolled energy and are usually integral to the system hardware. These include heat, cold, noise, radiation, electricity, pressure, fire, explosion, moving parts such as belts or pulleys, even height - a fall or impact hazard. Chemical hazards cause exposures by contact (either with people or materiel), skin absorption, inhalation, or ingestion, and are usually not integral to the hardware. Of course, chemical hazards can also have physical effects. Both physical and chemical hazards can cause injury or illness, as well as property and environmental damage. Some chemicals, such as mercury, are integral to hardware. What is important to the PM is to identify all sources of uncontrolled energy and chemical exposures to people, to equipment and to the environment, when incorporating ESH risk management issues into the system's design. Once potential hazards are identified, the PM can classify them by their potential severity and probability of occurrence.

6.4.5. Establish Severity & Probability of Occurrence Definitions/Criteria for ESH Hazards

Early in the design effort, PMs should establish definitions and criteria to characterize and rank identified ESH hazards. Figures 6.6 through 6.8 show typical severity and probability of occurrence definitions and risk criteria for environmental, safety, and health related hazards. These are only provided as suggestions; PMs may elect to develop their own criteria. This guide follows the standard DON alpha-numeric convention[64] for labeling severity and probability of occurrence.

The qualitative "probability of occurrence" levels in these figures are taken directly from the current operational risk management instruction[65]. Quantitative (i.e., numerical) probability levels have been added to assist PMs in more accurately categorizing levels of probability for individual hazards.

[64] OPNAVINST 3500.39 MCO 3500.27, Operational Risk Management, dated 3 April 1997.
[65] OPNAVINST 3500.39 MCO 3500.27, Operational Risk Management, dated 3 April 1997.

Severity	Probability of Occurrence (P)
Definition: Hazard in terms of damage to the environment and violation of law. **I Catastrophic** Irreversible environmental damage in violation of law. **II Critical** Reversible environmental damage in violation of law. **III Marginal** Reversible environmental damage with no violation of law. **IV Negligible** De minimus environmental damage.	**Definition: The probability of adversely impacting, the human environment over the life of the system.** **A Likely** *Fleet of systems* Continuously, P=1 *Individual system* Frequently, $1>P>10^{-1}$ **B Probable** *Fleet of systems* Frequently, $1>P>10^{-1}$ *Individual system* Several times, $10^{-1}>P>10^{-3}$ **C Occasional** *Fleet of systems* Several times, $10^{-1}>P>10^{-3}$ *Individual system* At some time, $10^{-3}>P>10^{-6}$ **D Remote** *Fleet of systems* At some time, $10^{-3}>P>10^{-6}$ *Individual system* Unlikely, $10^{-6}>P$

FIGURE 6.6 Environmental Hazards Definitions and Risk Criteria

Severity	Probability of Occurrence (P)
Definition: Hazards in terms of system damage/loss or personnel injury/death. **I Catastrophic** Loss of system or death. **II Critical** Major damage to system or permanent disabling injury. **III Marginal** Minor damage to system or minor injury or illness. **IV Negligible** Minimal damage to system and/or minimal threat to personnel safety & health.	**Definition: The probability of incurring a loss over the life of the system.** **A Likely** *Fleet of systems* Continuously, P=1 *Individual system* Frequently, $1>P>10^{-1}$ **B Probable** *Fleet of systems* Frequently, $1>P>10^{-1}$ *Individual system* Several times, $10^{-1}>P>10^{-3}$ **C Occasional** *Fleet of systems* Several times, $10^{-1}>P>10^{-3}$ *Individual system* At some time, $10^{-3}>P>10^{-6}$ **D Remote** *Fleet of systems* At some time, $10^{-3}>P>10^{-6}$ *Individual system* Unlikely, $10^{-6}>P$

FIGURE 6.7 Safety Hazards Definitions and Risk Criteria

Severity	Probability of Occurrence (P)
Definition: Hazards in terms of dosage (e.g., concentration vs times) of a substance, or induced loads (e.g., heat, cold, shock). **I Catastrophic** Dose of substance or induced stress levels leading to death. **II Critical** Dose of substance or induced stress levels leading to permanent disability. **III Marginal** Dose of substance or induced stress levels leading to impairment. **IV Negligible** Dose of substance or induced stress levels w/no adverse impacts.	**Definition: The probability of exposing occupants, work force or the public to certain exposure situations over the life of the system.** **A Likely** *Fleet of systems* Continuously, P=1 *Individual system* Frequently, $1>P>10^{-1}$ **B Probable** *Fleet of systems* Frequently, $1>P>10^{-1}$ *Individual system* Several times, $10^{-1}>P>10^{-3}$ **C Occasional** *Fleet of systems* Several times, $10^{-1}>P>10^{-3}$ *Individual system* At some time, $10^{-3}>P>10^{-6}$ **D Remote** *Fleet of systems* At some time, $10^{-3}>P>10^{-6}$ *Individual system* Unlikely, $10^{-6}>P$

FIGURE 6.8 Health Hazards Definitions and Risk Criteria

6.4.6. Prioritize the ESH Hazards By Risk Levels

Figure 6.9 shows how the MIL-STD-882C management concept assists PMs in ranking ESH hazards. This chart shows a hypothetical "decision-line" separating ESH hazards that, because of their combined severity and probability, must be corrected and those that will be accepted. The ESH hazards plotted to the right of the curve need to be corrected while those to the left do not. The curve is provided for illustrative purposes. After PMs have identified and categorized the ESH hazards by severity and probability of occurrence, they can begin to prioritize those that need to be corrected. ESH hazards can be grouped by the four quadrants shown on the chart.

- Upper right quadrant - These ESH hazards involve the greatest severity and the highest probability of happening. These hazards should have the highest priority for corrective action.
- Upper left quadrant - These ESH hazards involve the greatest severity also, but may not happen often. Correcting these hazards depends on how often they will occur throughout the life of the system. If the probability of the incident is extremely low, the PM may determine that the hazard should be accepted without corrective action.
- Lower right quadrant - These ESH hazards involve incidents that have relatively low severity (e.g., personnel injury but not death; or equipment damage but not total loss of the system) but will happen often during the life of the system. These hazards tend to be those "nagging" problems and can be significant cost drivers. Depending on the level of severity, PMs should ensure these receive adequate priority for corrective measures. If the severity is extremely low, PMs may choose to accept these hazards.
- Lower left quadrant. These are hazards that have very low severity and very low probability of occurrence. PMs may choose to accept these hazards.

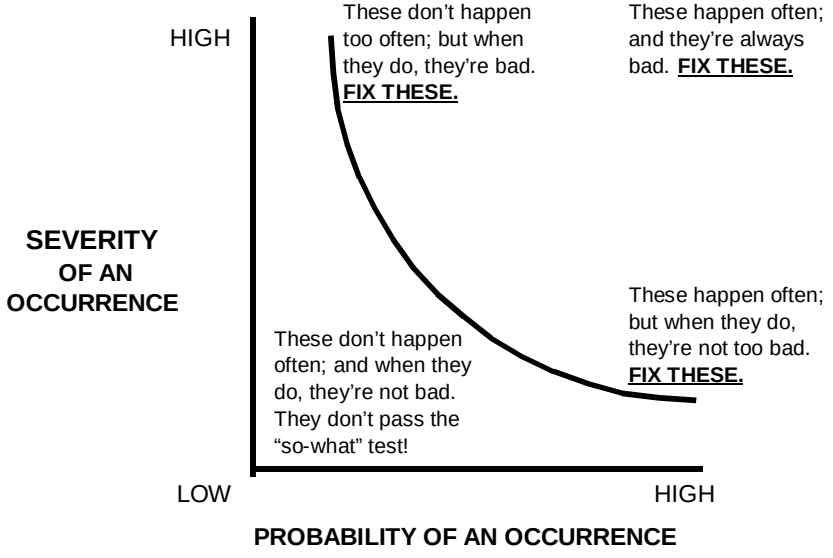

FIGURE 6.9 Hazard Priorities Based on Severity and Probability of Occurrence

6.4.7. Establish Risk Acceptance Levels for ESH Hazards

Once a risk level has been identified for a hazard, the PM should consider mitigation alternatives to eliminate or reduce the hazard to an acceptable level. When selecting these hazard mitigation alternatives, PMs should follow the hierarchy shown in Figure 6.1.

PMs should ensure risks are accepted at the required level of authority.

In previous discussions, the notion of "accepting" certain levels of risks has been mentioned. The authority to accept risks depends on the risk level. Figure 6.10 shows a typical ESH risk level acceptance matrix that PMs may use to establish the levels of risk. In this case, three levels (High, Serious, and Low) are used. In the case of DON, and in accordance with DOD mandatory requirements[66], the ASN(RDA) is the final approval authority for accepting high risk hazards. Serious risk hazards may be approved at the PEO level. For non-PEO managed NAVSEA programs, PMs should obtain approval from the Commander.

Probability of Occurrence Levels

Severity Levels	A	B	C	D
I	High*	High*	Serious**	Serious**
II	High*	High*	Serious**	Low
III	High*	Serious**	Low	Low
IV	Serious**	Serious**	Low	Low

***Must be accepted by ASN(RDA)** ****Must be accepted at PEO level**

FIGURE 6.10 Risk Acceptance Matrix

6.4.8. Establish an ESH Hazards Tracking Mechanism

As ESH hazards are identified, the ESHWG will begin to assist the PM in prioritizing corrective actions in order to optimize resources. As corrections are made to the design, levels of risk will decrease by reducing severity, probability of occurrence, or both. PMs have found that an ESH Hazards Tracking Database is helpful in order to effectively manage the various ESH hazards and keep track of their status. The ESHWG can provide insight to the PM for developing the specific mechanism by which ESH hazards can be tracked. Depending on the complexity of the system and the number and/or levels of the ESH hazards, this tracking mechanism could be a computerized database or simply a manually kept listing. The ESH

[66] DOD Regulation 5000.2R, Section 4.3.7.3.

Hazard Tracking Mechanism supports one of the three basic PESHE requirements for PMs to identify how they will track progress.

6.4.9. Prepare System Safety Program Portion of the Prime Contract Statement of Objectives/Statement Of Work (SOO/SOW) and Request For Proposals (RFP)

In most cases, the prime contractor will be required to conduct trade studies for the design. The PM should include the contractual requirement for the prime contractor to develop and implement an SP (in accordance with MIL-STD-882C, Task 101) as an integrated part of the design trade studies. PMs should refer to MIL-STD-882C for the other tasks necessary to manage ESH risks. In Section M of the RFP, PMs should include how the offerors will be evaluated. The PM should ensure the Source Selection Boards are staffed with knowledgeable environmental, safety, and health members. Government members of the PM's ESHWG are excellent candidates for Source Selection Boards.

6.5. WHEN SHOULD SYSTEM SAFETY AND HEALTH BE INTEGRATED?

During Phase 0 (i.e., CE), the PM should consider establishing and chartering the ESHWG and initiating an ESH Hazards database. During this phase, PMs can initially populate the ESH Hazards database with those fleet hazards identified in the ESH Compliance effort. In most cases, Phase I (PDRR) is when the prime contractor will conduct design trade studies. The SOO/SOW and RFP for PDRR should be prepared during CE and should include the requirements for the prime contractor to develop and implement the SP. As the system matures through the various acquisition phases, the PM should require that the prime contractor update the SP. Additional tasks from MIL-STD-882C should also be considered as the system matures.

6.6. OTHER SAFETY & HEALTH RELATED REQUIREMENTS

Other safety and health related requirements include occupational safety and health issues as described in OPNAVINST 5100.19C and OPNAVINST 5100.23D. Although these two documents primarily focus on the Navy Occupational Safety and Health considerations for forces/personnel Afloat and Ashore, PMs should understand the impact of their systems engineering decisions on the operational community.

The WSESRB may review the PM's ESH risk management in preparation for milestone reviews during each acquisition phase.

SECTION 7. HAZARDOUS MATERIALS MANAGEMENT

7.1. WHAT IS HAZARDOUS MATERIALS MANAGEMENT?

Through the HMMP, PMs ensure their contractors consider the elimination of hazardous materials in the design of the system.

PMs are required[67] to manage hazardous materials through a Hazardous Materials Management Program (HMMP) that ensures appropriate consideration is given to eliminating, rather than simply managing the pollution created. The selection, use, and disposal of hazardous materials shall be evaluated and managed so that the DOD incurs the lowest cost required to protect human health and the environment over the system's life cycle.

PMs are required[68] by the USD(A&T) to use National Aerospace Standard (NAS) 411[69] in all phases of all systems. NAS 411 is an industry standard developed and managed by the Aerospace Industries Association (AIA) to be applied to acquisition of systems. It applies to all acquisition phases. NAS 411 includes the requirements for the contractor HMMP and contains two DOD approved Data Item Descriptions (DIDs). The first DID[70] applies to the contractor's HMMP Plan and the second DID[71] applies to the contractor's HMMP Report. NAS 411 and the two DIDs are available from NAVSEA 00T.

While the Environmental Protection Agency (EPA) has strict legal definitions of hazardous materials, PMs should use the DOD definition included in approved policy[72]. In this case a hazardous material is:

> *"Anything that due to its chemical, physical, or biological nature causes safety, public health, or environmental concerns that result in an elevated level of effort to manage it."*

7.2. WHY INTEGRATE HAZARDOUS MATERIALS MANAGEMENT?

7.2.1. Successful Hazardous Materials Management Has Been Proven By Industry.

Industry has already successfully implemented hazardous materials management integration initiatives. Reasons for corporate hazardous materials management initiatives include reduced corporate liability in protecting human health, improved product line, enhanced environmental image, or even better environment stewardship. Nevertheless, industry always

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[67] DOD Regulation 5000.2R, Section 4.3.7.4.
[68] USD (A&T) memorandum, National Aerospace Standard (NAS411), 'Hazardous Materials Management Program', dated 19 January 1995.
[69] National Aerospace Standard 411 REV 2, Hazardous Materials Management Program, dated 29 April 1994.
[70] Data Item Description Number DI-MGMT-81398, Hazardous Materials Management Program (HMMP) Plan, approved 14 April 1994.
[71] Data Item Description Number DI-MGMT-81397, Hazardous Materials Management Program (HMMP) Report, approved 14 April 1994.
[72] DOD 4210.15, Hazardous Materials Pollution Prevention, dated 27 July 1989.

had a common theme - *to reduce overall costs.* Section 8.2 discusses the various cost drivers associated with hazardous materials and other pollution prevention contributions to TOC.

7.2.2. Disposal Liability is Best Minimized by Eliminating Materials that Generate the Waste

Many manufacturers erroneously believed that they would be protected from any prosecution if they simply paid someone to dispose of their wastes and pollutants. Disposal, even in accordance with the law, does not eliminate all the risks associated with hazardous wastes. Liability risks are best eliminated by avoiding the materials and processes that generate wastes and pollutants. Even if something should go wrong, federal prosecutors have been instructed to consider the defendant's intent. As a means of showing one's good faith with regard to environmental stewardship, it is much better to be in a proactive position of eliminating the waste or pollutant, rather than in a reactive position of controlling, storing, or disposing of the waste or pollutant *after* it has been generated.

7.2.3. Environmentally-friendly Materials and Processes Improve the System

Industry has shown that as environmentally-friendly materials, industrial processes, and maintenance techniques are introduced into product lines, the resultant end-item's quality improves. There are at least two basic reasons for this improvement:

- newer materials introduced into the product line are usually less expensive and easier to obtain; and
- recently developed, environmentally-friendly, and much more efficient manufacturing processes are being developed to replace older wasteful processes. In many of the newer processes, quality control is actually built into the process through in-process controls rather than inspected into the end-item afterwards. The result is an end-item that is cheaper to produce, has higher quality and is environmentally acceptable.

7.2.4. Industry Improved Customer Satisfaction by Eliminating Hazardous Materials

Companies have used hazardous materials management to gain favorable public response to their product and thus improve their position against competitors. Some PMs are using their hazardous materials management initiatives as a positive means of gaining approval at major decision reviews. Conversely, PMs have been, and will continue to be, adversely affected by *not* incorporating a hazardous materials management ethic within their programs.

7.2.5. Hazardous Materials Management Minimizes ESH Risks

Most hazardous materials are regulated because they pose hazards to the environment as well as to humans. When PMs eliminate their use of these hazardous materials, they protect the environment as well as people. Program reviews (e.g., program milestone reviews) often include MDA review of the PM's planned hazardous materials management issues for the next phase.

7.2.6. Hazardous Materials Management Minimizes Operational Support Risks

PMs can minimize future operational support risks through an effective HMMP.

From an environmental perspective, many toxic and hazardous materials/chemicals are often used in component and system mission critical applications. ESH laws and regulations tend to drive suppliers of these substances out of the marketplace because of the increasing costs and liabilities associated with their manufacture and use. As the industrial base shrinks, operational readiness is at risk with those systems relying on these substances for operation and maintenance. For example, Ozone Depleting Substances (ODSs) which will no longer be produced worldwide, are currently used in almost every aspect of weapon systems. These applications include: fire fighting, electronics cooling, precision cleaning, protective coatings, and even munitions manufacture. Other chemicals (e.g., chrome and cadmium, used as coatings in propulsion plants, gun tubes, and other mission critical applications) are also being phased out of industry. Continuing to rely on these chemicals will only increase the risk to operational readiness.

7.3. WHO SHOULD INTEGRATE HAZARDOUS MATERIALS MANAGEMENT?

The PM is responsible for ensuring the prime contractor implements an HMMP. The PM is ultimately responsible for the elimination of hazardous materials from the design of the system. PMs should have the insight into their contractor's HMMP to know what hazardous materials may be used. If the design includes hazardous materials, the PM is responsible to develop and implement plans and procedures for identifying, minimizing use of, tracking, storing, handling, packaging, transporting, and disposing of the materials or equipment using the materials.

The PM may decide to use a hazardous material for many reasons (e.g., no other material meets the performance requirements, LCC considerations are minimized with the hazardous material, supply of an alternative is not available in time for the program's schedule, or time and/or resources are not available to prove-out the alternative). In these cases, the PM is still required to replace the hazardous material in the system where technically and economically practical.

The ESHWG can assist the PM in gaining the proper level of insight into the contractor's HMMP.

As previously mentioned, the prime contractor usually conducts the trade studies that select materials and processes. PMs must therefore include contract requirements so that these systems engineers are required to include hazardous materials management in their trade studies. The ESHWG can assist the PM in gaining the proper level of insight into the contractor's HMMP. When identifying and testing less hazardous materials, PMs can minimize costs by working with the contractor and other PMs and by coordinating efforts with the Supervisor of Shipbuilding.

7.4. HOW SHOULD HAZARDOUS MATERIALS MANAGEMENT BE INTEGRATED?

7.4.1. Utilize the Multi-disciplined Experience of the ESHWG

PMs should consider assigning the responsibility to maintain insight into the contractor's HMMP to the ESHWG. The PM can effectively integrate HMMP issues into the other ESH considerations by using the ESHWG to support the HMMP effort.

7.4.2. Ensure Hazardous Materials Management is Integrated into Other ESH Areas

Reducing the use of hazardous materials in the design will also mitigate potential adverse impacts associated with NEPA considerations and ESH risks. PMs should be sure to integrate the HMMP results into the NEPA analysis, the SP, and the PPP.

7.4.3. Use the DOD and Industry Supported Standard

PMs can ensure that their contractor's develop and implement an effective HMMP by using NAS 411. If PMs do not wish to specify NAS 411 in their contract SOO/SOW, they should cite NAS 411 in Section M of the RFP. By using NAS 411 in the Source Selection, the PM is sending the proper signal to the offerors that their HMMP proposals should at least meet the tenets of NAS 411.

7.4.4. Use the ESH Hazards Risk Management Concepts for the HMMP

The ESH Hazards risk management concepts discussed in Section 6.4 will ensure a balanced and integrated approach is used for the elimination of hazardous materials. The ESH Risk criteria in Figures 6.2 through 6.3 can be applied to the HMMP effort. Elimination of identified hazardous materials can then be accomplished by following the prioritization process shown in Figure 6.5. The use of hazardous materials may pose High or Serious ESH risks as defined in Figure 6.6, and as such, their use may require the approval of higher authority.

7.4.5. Integrate the HMMP Effort into the ESH Hazards Tracking Mechanism

PMs can effectively comply with the requirement to track and find alternatives to the hazardous materials included in their systems by including the applications of these materials in the ESH Hazards Tracking Mechanism, described in Section 6.4.7.

7.4.6. Initiate the HMMP Effort with a List of Targeted Hazardous Materials

PMs should first identify and prioritize those hazardous materials that are currently ESH cost drivers for the Afloat and Ashore communities so they do not perpetuate the problems. The information from the ESH Compliance analysis, described in Section 5,

Figures 7.1 through 7.4 list hazardous materials known to be cost drivers. SD-14 provides a more complete list of over 3,000 chemicals.

can be used as an initial input to this portion of the HMMP. Hazardous materials that are typically identified as cost drivers throughout DOD are the EPA 17, Class I ODSs, and Class II ODSs. These chemicals are listed in Figures 7.1 through 7.3, respectively. Other current hazardous materials cost drivers that are not on these lists are shown in Figure 7.4. DOD has compiled a listing[73] of over 3,000 toxic chemicals, hazardous substances, and ODSs. PMs may use this more complete listing.

While prohibiting all of the identified hazardous materials may be impractical, PMs may consider prohibiting some classes of hazardous materials, such as Class I and Class II ODSs. Suitable alternatives exist for most of these ODSs. Before prohibiting other hazardous materials, PMs should determine that suitable alternatives exist.

7.5. WHEN SHOULD HAZARDOUS MATERIALS MANAGEMENT BE INTEGRATED?

During Phase 0 (CE), the PM should consider initiating an HMMP within the program office, even before a prime contract is awarded. During this phase, PMs can initially populate the ESH Hazards database with those fleet hazardous materials identified in the ESH Compliance effort. In most cases, Phase I (PDRR) is when the prime contractor will conduct design trade studies. The SOO/SOW and RFP for PDRR should be prepared during CE and should include the requirements for the prime contractor to develop and implement the HMMP. As the system matures through the various acquisition phases, the PM should require that the prime contractor update the HMMP using NAS 411 as guidance.

BENZENE	**METHYL ETHYL KETONE**	**CARBON TETRACHLORIDE**
CADMIUM	**METHYL ISOBUTYL KETONE**	**CHROMIUM**
NICKEL	**TETRACHLOROETHYLENE**	**CHLOROFORM**
TOLUENE	**TRICHLOROETHANE**	**DICHLOROMETHANE**
CYANIDE	**TRICHLOROETHYLENE**	**LEAD**
XYLENE	**MERCURY**	

FIGURE 7.1 EPA's LIST OF 17 TOXIC CHEMICALS

[73] Defense Standardization Program SD-14, Listing of Toxic Chemicals, Hazardous Substances, and Ozone-Depleting Chemicals, dated August 1994.

GROUP I CHEMICALS		
CFCl3 (CFC-11) **Trichlorofluoromethane**	**CF2Cl2 (CFC-12)** **Dichlorodifluoromethane**	**C2F3Cl3 (CFC-113)** **Trichlorotrifluoroethane**
C2F4Cl2 (CFC-114) **Dichlorotetrafluoroethane**	**C2F5Cl (CFC-115)** **Monochloropentafluoroethane**	
GROUP II CHEMICALS		
CF2ClBr (Halon 1211) **Bromochlorodifluoromethane**	**CF3Br (Halon 1301)** **Bromotrifluoromethane**	**C2F4Br2 (Halon 2402)** **Dibromotetrafluoroethane**
GROUP III CHEMICALS		
CF3Cl (CFC-13) **Chlorotrifluoromethane**	**C2FCl5 (CFC-111)** **Pentachlorofluoroethane**	**C2F2Cl4 (CFC-112)** **Tetrachlorodifluoroethane**
C3FCl7 (CFC-211) **Heptachlorofluoropropane**	**C3F2Cl6 (CFC-212)** **Hexachlorodifluoropropane**	**C3F3Cl5 (CFC-213)** **Pentachlorotrifluoropropane**
C3F4Cl4 (CFC-214) **Tetrachlorotetrafluoropropane**	**C3F5Cl3 (CFC-215)** **Trichloropentafluoropropane**	
C3F6Cl2 (CFC-216) **Dichlorohexafluoropropane**	**C3F7Cl (CFC-217)** **Monochloroheptafluoropropane**	
GROUP IV		
CCl4 (CARBON TETRACHLORIDE)		
GROUP V		
C2H3Cl3 (METHYL CHLOROFORM) **1,1,1 Trichloroethane**		
GROUP VI		
CH3Br (METHYL BROMIDE)		
GROUP VII		
HBFCs **Hydrobromofluorocarbons**		

FIGURE 7.2 CLASS I ODSs)

HCFC-21	**Dichlorofluoromethane**	**HCFC-22**	**Monochlorodifluoromethane**
HCFC-31	**Monochlorofluoromethane**	**HCFC-121**	**Tetrachlorofluoroethane**
HCFC-122	**Trichlorotrifluoroethane**	**HCFC-123**	**Dichlorotrifluoroethane**
HCFC-124	**Monochlorotetrafluoroethane**	**HCFC-131**	**Trichlorofluoroethane**
HCFC-132	**Dichlorodifluoroethane**	**HCFC-133**	**Monochlorotrifluoroethane**
HCFC-141(b)	**Dicholofluoroethane**	**HCFC-142(b)**	**Monochlorodifluoroethane**
HCFC-221	**Hexachlorofluoropropane**	**HCFC-222**	**Pentachlorodifluoropropane**
HCFC-223	**Tetrachlorotrifluoropropane**	**HCFC-224**	**Trichlorotetrafluoropropane**
HCFC-225	**Dichloropentafluoropropane**	**HCFC-226**	**Monochlorohexafluoropropane**
HCFC-231	**Pentachlorofluoropropane**	**HCFC-232**	**Tetrachlorodifluoropropane**
HCFC-233	**Trichlorotrifluoropropane**	**HCFC-234**	**Dichlorotetrafluoropropane**
HCFC-235	**Monochloropentafluoropropane**		
HCFC-241	**Tetrachlorofluoropropane**	**HCFC-242**	**Trichlorodifluoropropane**
HCFC-243	**Dichlorotrifluoropropane**	**HCFC-244**	**Monochlorotetrafluoropropane**
HCFC-251	**Trichlorofluoropropane**	**HCFC-252**	**Dichlorodifluoropropane**
HCFC-253	**Monochlorotrifluoropropane**	**HCFC-261**	**Dichlorofluoropropane**
HCFC-262	**Monochlorodifluoropropane**	**HCFC-271**	**Monochlorofluoropropane**

FIGURE 7.3 CLASS II ODSs

LITHIUM

BERYLLIUM

ADVANCED COMPOSITES (PARTICULARLY WITH BORON FIBERS)

DEPLETED URANIUM (ARMOR & MUNITIONS)

HYDRAZINE

FIGURE 7.4 OTHER HAZARDOUS MATERIALS TO AVOID

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SECTION 8. POLLUTION PREVENTION

8.1. WHAT IS POLLUTION PREVENTION?

PMs must address "all forms" of pollution, from chemicals as well as from noise and other emissions in all media.

PMs are required[74] to establish a Pollution Prevention Program (PPP) to help minimize environmental impacts and the life-cycle costs associated with environmental compliance. All forms of pollution shall be prevented or reduced at the source in designing, manufacturing, testing, operating, maintaining, and disposing of systems. Only recently has a clear definition of pollution prevention been officially published. E.O. 12856[75] was a major step in more accurately defining (or perhaps refining) exactly what pollution prevention is and how it relates to the other, more traditional, environmental concepts of recycling, treatment (pollution control), and disposal. E.O. 12856 defines pollution prevention as "source reduction" and more importantly differentiates among the other three environmental issues by establishing a hierarchy of decisions for federal agencies to follow in their management and acquisition activities. This hierarchy is shown in Figure 8.1.

PMs should note that the requirement in the PPP is to eliminate or reduce ***all forms*** of pollution. This not only applies to pollution caused by hazardous materials, but also to emissions, effluent discharges, chemical leaching, overpressures (from gun blasts), and noise pollution across all media. In some cases, where test range construction may adversely impact the scenery of a national park, pollution can also include aesthetics.

REDUCE POLLUTION THROUGH PREVENTION.

POLLUTION THAT IS GENERATED SHOULD BE RECYCLED.

POLLUTION THAT CAN'T BE RECYCLED SHOULD BE TREATED.

ENVIRONMENTALLY RESPONSIBLE DISPOSAL IS THE LAST ALTERNATIVE.

FIGURE 8.1 Environmental Hierarchy

[74] DOD Regulation 5000.2R, Section 4.3.7.5.

[75] E. O. 12856, entitled: "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," dated 3 August 1993.

8.2. WHY INTEGRATE POLLUTION PREVENTION?

From a pollution prevention perspective, costs for disposing of a barrel of toxic waste have increased dramatically over the past decade; and there is every indication that these costs will continue to skyrocket. These costs are driven by two major factors. The first factor is the increase in the number of more stringent laws governing the disposal of hazardous wastes. The second is the decrease in the number of sites that will accept hazardous materials. From past studies[76] of DOD Operations and Support (O & S) costs, disposal costs can be 26% of the total hazardous materials management cost. A significant finding in the study shows that 42% of the total cost goes for personal protection and potential liability. Figure 8.2 shows the data.

COST ELEMENT	PERCENTAGE OF O & S COSTS
PERSONAL PROTECTION	10%
POTENTIAL LIABILITY	32%
MEDICAL	5%
PROCUREMENT	15%
MANAGEMENT	4%
DISPOSAL	26%
HANDLING	8%

FIGURE 8.2 O & S Cost Breakout for Hazardous Materials Management

PMs who integrate pollution prevention into the systems engineering process reduce DON's liabilities through the life cycle of their systems. Systems designed with effective pollution prevention integration tend to be better performers and are easier to support.

For all competitively selected contracts over $100K, PMs must require that the contractor complies with EPCRA.

In response to constituent pressure and public reaction to the worldwide human tragedies and environmental catastrophes (such as the loss of life in Bhopal, India), Congress passed the Emergency Planning and Community-Right-To-Know Act (EPCRA)[77]. This law requires public disclosure of certain chemicals identified by the Environmental Protection Agency (EPA). The disclosure report under EPCRA is called the Toxic Release Inventory (TRI). The EPA EPCRA list includes over three thousand chemicals.[78] TRI reporting provides the public; industry; and federal, state, and local governments with a basic tool for making risk-based decisions about management and control of toxic chemicals. Recognizing the importance of integrating ESH

[76] Human Systems Center Report TR-6301-7-3, Hazardous Materials Management Life Cycle Cost Model Phase I - Navy Module, dated 23 November 1992.
[77] 42 USC 11001-11050, Emergency Planning and Community Right-To-Know Act (also known as Title III of the Superfund Amendments and Reauthorization Act (SARA)) of 1986.
[78] Environmental Protection Agency 740-R-95-001, Title III List Of Lists, dated April 1995.

issues into the acquisition process, E.O. 12969[79] was signed by President Clinton in 1995. Among other things, this E.O. requires that all competitive contracts over $100,000 include a compliance requirement with the EPCRA's TRI reporting process.

Systems designed and fielded through a systems engineering process that integrates pollution prevention are cheaper to operate over the life cycle, easier to maintain, and less likely to cause adverse operational impacts from NOVs and other adverse legal actions. Program reviews (e.g., program milestone reviews) often include MDA review of the PM's planned pollution prevention issues for the next phase.

8.3. WHO SHOULD INTEGRATE POLLUTION PREVENTION?

PMs are required to establish a PPP. Many PMs are confused with this requirement and the HMMP. As described in DOD Regulation 5000.2 -R and the memorandum from the USD(A&T)[80], the HMMP is primarily the contractor's program to eliminate/reduce hazardous materials from the design, manufacturing, and support concepts of the end-item. In contrast, the PPP is the PM's overarching effort to reduce pollution throughout the life cycle of the system. In this situation, the HMMP is a major sub-set of the PM's overarching PPP. The PPP also includes how recycling in accordance with E.O. 13101[81] will be accomplished and how the PM may leverage the Acquisition Pollution Prevention Initiative[82] (AP2I).

The ESHWG can assist the PM in gaining the proper level of insight into the contractor's PPP.

The prime contractor usually conducts the trade studies that select the materials and components that might pollute the environment. PMs must therefore include contract requirements so that the contractor's systems engineers are required to include pollution prevention in their trade studies. With input from the contractor, the PM can update the overall PPP. The ESHWG can assist the PM in gaining the proper level of insight into the contractor's portion of the overarching PPP.

8.4. HOW SHOULD POLLUTION PREVENTION BE INTEGRATED?

8.4.1. Utilize the Multi-disciplined Experience of the ESHWG

PMs should consider assigning the responsibility to maintain insight into the contractor's portion of the PPP to the ESHWG. The PM can effectively integrate PPP issues into the other ESH considerations by using the ESHWG to support the PPP effort.

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[79] E.O. 12969, Federal Acquisition and Community Right-To-Know, dated 8 August 1995.
[80] USD (A&T) memorandum, dated 19 January 1995.
[81] E.O. 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, dated 14 September 1998 (Revokes E.O. 12873).
[82] USD(A&T) memorandum, Acquisition Pollution Prevention Initiative, dated 15 May 1997.

8.4.2. Ensure Pollution Prevention is Integrated into Other ESH Areas

Incorporating pollution prevention in the design will also mitigate potential adverse impacts associated with NEPA considerations and ESH risks. PMs should be sure to integrate the PPP results into the NEPA analysis, SP, and the HMMP.

8.4.3. Use the ESH Hazards Risk Management Concept for the PPP

The ESH Hazards risk management concept discussed in Section 6.4 will ensure a balanced and integrated approach is used for pollution prevention. The Risk criteria in Figures 6.2 through 6.3 can be applied to the HMMP effort. Elimination of identified pollution can then be accomplished by following the prioritization process shown in Figure 6.5. Some pollution may pose High or Serious ESH risks as defined in Figure 6.6, and as such, their use may require the approval of higher authority.

8.4.4. Integrate the PPP Effort into the ESH Hazards Tracking Mechanism

PMs can effectively comply with the requirement to track pollution impacts of their systems by including these issues in the ESH Hazards Tracking Mechanism, described in Section 6.4.7.

8.4.5. Initiate the PPP Effort with a List of Current Pollution Issues

PMs can initially use the information from their ESH Compliance analysis, described in Section 5. PMs should first identify and prioritize those pollution issues that are currently ESH cost drivers for the Afloat and Ashore communities so they do not perpetuate the problem. Pollution issues that are typically identified as cost drivers throughout DOD are effluent discharges, chemical leaching, and noise pollution across all media.

8.4.6. Utilize Existing Federal Facilities to Verify Pollution Prevention Corrective Actions

Where it makes sense, the PM may elect to implement certain pollution prevention elimination/reduction efforts within government facilities. This might be done for various reasons. One reason might be that the government facility has better capabilities to verify alternative materials or components. Another reason might be that the PM's effort could be part of a larger pollution prevention effort at the government facility so that the PM can leverage this existing resource. An example of the first situation exists in the area of testing alternative fire suppression agents to eliminate reliance on Class I ODSs (commonly referred to as Halons). The DON owns test facilities to conduct system verification tests that have all of the necessary instrumentation, experienced test personnel, required permitting, and proven track record to conduct these critical tests. The PM would include these tests in the overall PPP. The results of the tests would of course be shared with the contractor as input for the trade studies and eventual incorporation of the Halon alternative into the system's design.

Some pollution prevention related efforts can be placed under contract as well. PMs should require the use of recovered/recycled materials and other environmentally preferable products whenever possible.

8.5. WHEN SHOULD POLLUTION PREVENTION BE INTEGRATED?

During Phase 0 (CE), the PM should consider initiating a PPP within the program office, even before a prime contract is awarded. During this phase, PMs can initially populate the ESH Hazards database with those fleet pollution problems identified in the ESH Compliance effort. In most cases, Phase I (PDRR) is when the prime contractor will conduct design trade studies. The SOO/SOW and RFP for PDRR should be prepared during CE and should include the requirements for the prime contractors to develop and implement their PPPs. As the system matures through the various acquisition phases, the PM should require that the prime contractor update the PPP. The contractor's PPP serves as an input for the PM's overarching PPP.

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SECTION 9. PROGRAMMATIC ISSUES

9.1. SHIP ACQUISITION HAS THE MOST COMPLEX PROGRAMS WITHIN DOD

Integrating ESH considerations into the systems engineering process for ship acquisition is a significant challenge. Even smaller, less complex ships are more complicated from an ESH perspective than most programs in other services. Unlike any other system within DOD, ships are in essence floating facilities that must support the crew for extended periods, with on-board weapons, propulsion plants, and (in some special cases) a fully functioning air facility, a petroleum supply facility, or an ammunition supply facility. Ship Acquisition Program Managers (SHAPMs) must address all of the ESH considerations of a facility (e.g., waste water effluent, "hotel" services, and occupational safety and health). At the same time, these managers must address all of the operational combat systems that are influenced by ESH considerations.

SHAPMs should ensure supporting system, sub-system, and component PMs have integrated ESH considerations into their programs.

9.2. TAILORING ESH PLANNING AND IMPLEMENTATION

As with other acquisition management considerations, ESH analyses and integration must be a concept that is threaded throughout the systems engineering and management processes and must be tailored for the specific program application**.** Mandatory requirement for all programs have been addressed. Some management techniques that apply to larger programs have also been discussed. PMs, Project Officers, or Logistics Managers responsible for other acquisition-related efforts should tailor the previous guidance for their specific programs. In most cases, the thought processes and basic technical concepts are the same. The availability of resources (particularly full-time ESH expertise) is what is different. The following information will provide some of the more successful tailoring concepts that should be considered. Keep in mind that there are few rigid rules to follow. PMs for smaller programs should exercise their knowledge of their programs, the critical issues associated with the acquisition approach being followed, and their *own initiative.* SEA 00T is available on a case by case basis to provide advice and limited assistance. The members of the NAVSEA Environmental Working Group are shown in Appendix D.

9.2.1. Tailoring ESH Analyses and Activities for the Acquisition Phase

ESH analyses and activities will vary depending on the complexity of the system and the phase. Appendix C shows a listing of recommended analyses and activities by acquisition phase. PMs should tailor their SOO/SOW to include the necessary requirements for the contractor's tasks to support ESH integration into the systems engineering process.

9.2.2. Tailoring for Commercial/Non-Developmental Item (C/NDI) Programs

In many programs managed by NAVSEA, the approach followed is C/NDI. In these cases, it is important that the PM does not impose requirements on the prospective offerors that defeat the benefits of acquiring these typically less expensive and readily available items. *This does not relieve the PM of the responsibility to ensure the ESH issues have in fact been properly addressed by the prospective offeror.*

Managers of these programs should ensure they are informed consumers. They can gain insight into many ESH issues by asking the prospective offeror to address how ESH considerations have been incorporated in the item under consideration. This can be most effectively accomplished by conducting a market survey/market investigation that includes ESH questions and by asking for the prospective offeror's input as a portion of the response to the solicitation. This response should also be used as a portion of the source selection process in selecting the winning contractor(s). Figure 9.1 provides typical ESH Market Survey/Market Investigation questions.

Program documentation for C/NDI programs should reflect the ESH-related risks associated with each functional area and the mitigating measures being taken to reduce these risks throughout the life cycle of the end-item. Program documents should address how ESH considerations have been incorporated.

9.2.3 Tailoring for In-Service Programs

For In-Service Programs, the preparation of Ship Alterations (SHIPALTs) and Ordnance Alterations (ORDALTs) are like new systems. Managers should integrate ESH considerations into the systems engineering process associated with the particular alteration. The ESH concepts discussed in this guide directly apply to alteration planning. Managers should ensure ESH integration is accomplished during the development of the alteration record, Basic Alteration Class Drawings (BACDs), material requirements, and required industrial processes.

9.3. MANDATORY PM DOCUMENTATION

Laws or other regulations (e.g., NEPA, FAR) mandate specific program documentation (e.g., EA/EIS, TEMP, Acquistion Plan (AP)). In addition, ASN(RDA) requires[83] a Navy Training Systems Plan (NTSP) (formerly the Navy Training Plan) and, if required by the MDA, a Technology Assessment and Control Plan (TACP). The AS includes the PESHE and is one of the few documents mandated by DOD and ASN(RDA) to support milestone decisions. Other program plans that describe the details of a PM's activity to execute the acquisition program belong to the PM. With the exception of the aforementioned documents, PMs shall determine and approve the type and number of these other program plans in coordination with the ACT (when established).

[83] SECNAVINST 5000.2B, Section 3.6, p. 19.

1. Does the offeror voluntarily participate in the EPA's TRI Program (sometimes referred to as the "EPA-17 Program" or the "33-50 Program)?

2. Does the end-item use any of the EPA's Class I ODSs, Class II ODSs, any of the EPA-17 toxic substances, beryllium, lithium, hydrazine, DU, or Global Warming Gases in its design, manufacture, operation, or maintenance?

3. Has the offeror implemented a HMMP within its design and manufacturing practices?

4. Has the offeror adequately addressed the LCC associated with the ESH considerations of its end-item?

5. Has the offeror adequately instituted ESH requirements for its vendors and sub-contractors who supply the materials, components and sub-assemblies used in its end-item?

6. Does the offeror effectively integrate ESH considerations into the design of the end-item?

7. What is the offeror's past performance related to ESH issues?
Note: This issue can include obtaining and reviewing TRI trends over the past five years, plant safety records, recalls of end-item for safety or health problems, and the trend in the number of fines and Notices Of Violation (NOVs).

8. Does the offeror utilize an ESH risk management concept that identifies, eliminates, and manages hazards?

9. Does the offeror have the correct mix of functional disciplines and are the people in these disciplines at the correct level to effectively balance ESH considerations on an equal basis with other design/performance issues?

FIGURE 9.1 Sample ESH-related Market Survey/Investigation Questions

9.3.1. NEPA Documentation

NEPA documentation shall be prepared in accordance with the procedures outlined in OPNAVINST 5090.1B CH-1, Chapter 2. Final authority for NEPA documentation is found in SECNAVINST 5000.2B.

The PM can ensure the quality of the NEPA analyses and documentation by preparing the analyses and documentation with the assistance of the program's multi-disciplined ESHWG.

9.3.2. TEMP

PMs should ensure ESH considerations are addressed in the TEMP. Obviously NEPA will be an issue for DT. Before testing takes place, the PM should ensure any high and serious risks have been accepted by the appropriate authority. The TEMP may also include verification of new non-hazardous materials and/or industrial processes.

Testing without proper ESH planning has been a significant area of problems for PMs. Courts have stopped those programs that are unable to demonstrate compliance with the NEPA thought process. Test and program personnel can be injured and killed in cases where significant safety and health hazards are not identified and mitigated before tests are conducted. TEMPs should address the following issues:

Where will testing take place?

- Do the test locations include habitats for endangered or threatened species, or contain historical, cultural, or archeological resources?
- Are the test locations near populated areas where pollutants, noise, or other adverse impacts may result?
- Do the test locations already have environmental problems that will be worsened by the program's testing?

What types of tests will be conducted?

- Will the contractor conduct tests? If so, has the program ensured that no ESH problems will result that might involve government liabilities?
- Will government testing involve materials or other requirements which could adversely impact the environment or personnel safety and health?
- Have all other ESH documents, such as the appropriate NEPA and safety/health documentation, addressed these issues; and have adequate mitigating measures been incorporated into the program planning effort and approved at the correct level of authority?

When will the testing take place?

- Will there be migrating or nesting of endangered/threatened species during this time?

9.3.3. Acquisition Plan (AP)

The acquisition plan may address key ESH issues for the contract under consideration and describe specific deliverables and why they are needed by the PM.

9.3.4. Navy Training Systems Plan (NTSP)

The NTSP might include specific ESH training or certification required by Ashore or Afloat personnel. For example, if Halon will be handled by operational or maintenance personnel, EPA requires[84] that they be trained.

9.3.5. Technology Assessment and Control Plan (TACP)

The TACP might include specific technologies required to eliminate a high or serious ESH hazard. The TACP would include a PM's plan to budget for the new technology and the programmatic risks associated with the new technology.

9.3.6. AS and PESHE

The PESHE is a portion of the AS. The PESHE describes the PM's strategy for meeting ESH requirements mandated in Sections 4.3.7 of both DoD Regulation 5000.2-R and SECNAVINST 5000.2B; establishes responsibilities; and identifies how the progress will be tracked.

In this context and in accordance with the references cited above, the PESHE is not a stand-alone document and should not contain unnecessary details in terms of the information needed by the MDA. Although a PM, in consultation with the PEO and the ACT, may in fact elect to prepare a more detailed ESH master plan, no such plan is required. While the MDA requires no detailed stand-alone ESH master plan, PMs are advised that the analyses and documentation to support ESH requirements must be performed and documented. Legal requirements (e.g., NEPA, ESH Compliance) and functional considerations (e.g., SP, HMMP, PPP) drive these analyses and documentation. The PESHE should address these issues in sufficient detail to ensure the MDA can make an informed decision regarding the PM's acquisition strategy. PMs have successfully transitioned milestones with a programmatic ESH evaluation of less than five pages contained within their Acquisition Strategies or Single Acquisition Management Plans (SAMPs).

The five topic areas that must be addressed in the programmatic ESH evaluation are: (1) NEPA; (2) ESH Compliance; (3) Safety and Health; (4) Hazardous Materials; and (5) Pollution Prevention. PMs are strongly reminded that these five issues are interrelated and should not be treated as stand-alone considerations. For example, some NEPA mitigation may be accomplished through the reduction or elimination of hazardous materials. Additionally,

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[84] 40 CFR Part 82, Protection of Stratospheric Ozone: Manufacture of Halon Blends, Intentional Release of Halon, Technician Training and Disposal of Halon-Containing Equipment - Final Rule, Federal Register/Vol. 63, No. 43/Rules and Regulations, dated 5 March 1998.

elimination of system safety hazards that could result in accidents that impact the environment would also contribute to mitigation under NEPA.

The following guidance for each of these five topic areas assists the PM in addressing the strategy for meeting these requirements, establishing responsibilities, and tracking progress.

NEPA

Strategy for compliance. Identify how NEPA analysis has been integrated as a forcing function into the program's decision-making process in accordance with OPNAVINST 5090.1B, CH-1. As a minimum, describe how impacts to the human environment have influenced (and will continue to influence) test decisions.

Establishing responsibilities. Clearly state that the PM is the proponent for NEPA analysis and for those program-related actions (e.g., DT) with the potential for impacting the human environment. Identify the approval authority for past and projected NEPA documentation approvals (refer to SECNAVINST 5000.2B, Section 4.3.7.1). Address any other action proponents involved in the next phase (e.g., CINCs, OPTEVFOR).

Tracking progress. Discuss the NEPA analyses conducted in previous phases and the documentation and pertinent issues associated with these analyses. Identify program actions during the next phase that may require NEPA documentation. Showing a timeline for upcoming actions is recommended. As a minimum, identify that the program has established an administrative record (a file of NEPA and other ESH-related documentation) that will be used to track the NEPA process as it relates to the program.

ESH COMPLIANCE

Strategy for compliance. Identify how ESH laws have impacted the program to date. This might include the CAA production ban on ODSs. It may also include the requirements to protect personnel from excessive exposure to chemicals such as beryllium. Identify how systems engineering decisions, such as those associated with trade studies, have incorporated (and will continue to incorporate) compliance to ESH laws as a requirement. Describe how ESH compliance decisions are based on Total Ownership Costs over the system's life cycle to include disposal. As a minimum, PMs are encouraged to baseline their systems against currently fielded (i.e., in-service systems) to identify ESH compliance problems and drivers in these in-service systems so that actions can be taken to avoid the same impacts in the system under development.

Establishing responsibilities. Clearly state that the PM is responsible for ESH compliance of the overall program. Describe how the prime contractor has been required to integrate ESH compliance considerations into the systems engineering process (including trade studies) and how the contractor will be required to continue this effort.

Tracking progress. Discuss how the ESH compliance impacts have been avoided, mitigated, or accepted. As a minimum, identify those ESH compliance issues that may still adversely impact the system over its life cycle.

SAFETY AND HEALTH

Strategy for compliance. Identify how systems engineering decisions, such as trade studies, have incorporated safety and health considerations as a requirement. Describe how safety and health decisions are based on Total Ownership Costs over the system's life cycle to include disposal. This might include how MIL-STD-882C has been used and tailored in the previous phase and how it will be used in the next phase.

Establishing responsibilities. Identify how high and serious hazards will be accepted only at those levels of authority stated in Section 4.3.7.3 of DoD Regulation 5000.2-R. Describe how the prime contractor has been required to integrate safety and health considerations into the systems engineering process (including trade studies).

Tracking progress. Discuss how safety and health hazards have been avoided, mitigated, or accepted. As a minimum, identify those safety and health issues that may still adversely impact the system over its life cycle. Establishing an integrated ESH hazards tracking system is strongly encouraged. Include the definitions of hazard categories in terms of severity and probability of occurrence and include a listing of all identified high and serious hazards that may require acceptance at authority levels above the PM. Include charts similar to Figures 6.2, 6.3, 6.4, and 6.6 to illustrate the ESH risk management concept the program is following.

HAZARDOUS MATERIALS

Strategy for compliance. Identify how systems engineering decisions, such as trade studies, have incorporated the reduction/elimination of hazardous materials considerations as a requirement. Describe how hazardous materials management decisions are based on Total Ownership Costs over the system's life cycle to include disposal. This might include how NAS 411 has been used and tailored in the previous phase and how it will be used in the next phase. Describe how hazardous materials elimination/reduction efforts and new technologies from outside sources (e.g., other programs within the federal government, industry, and academia) have been (and will continue to be) leveraged.

Establishing responsibilities. Identify how specific hazardous materials are prioritized for elimination/reduction in terms of severity and quantities used. Describe how the prime contractor has been required to integrate hazardous materials management considerations into the systems engineering process (including trade studies).

Tracking progress. Discuss how the use of hazardous materials has been avoided, mitigated, or accepted. As a minimum, identify those hazardous materials that may still be used in the system over its life cycle.

POLLUTION PREVENTION

Strategy for compliance. Identify how systems engineering decisions, such as trade studies, have incorporated the pollution prevention considerations as a requirement. Describe how pollution prevention decisions are based on Total Ownership Costs over the system's life cycle to include disposal. This might include how the pollution prevention prioritization contained in Section 4.3.7.5 of DoD Regulation 5000.2-R (i.e., prevent, recycle, treat, dispose) has been used and tailored in the previous phase and how it will be used in the next phase.

Establishing responsibilities. Identify how pollution prevention affects (either positively or negatively) the three aspects of the system's life cycle (i.e., acquisition, ashore, and afloat). Describe how the prime contractor has been required to integrate pollution prevention considerations into the systems engineering process (include trade studies).

Tracking progress. Discuss how pollution prevention affects (either positively or negatively) the three aspects of the system's life cycle (i.e., acquisition, ashore, and afloat). As a minimum, identify the details of pollution prevention (e.g., prevent, recycle, treat, and dispose) that will be implemented over the system's life cycle. This might include a recycling/treatment/disposal program of a required hazardous material that cannot be prevented cost effectively. Aspects of this recycling effort should be addressed in acquisition (e.g., a manufacturing concept), afloat (e.g., a shipboard recycling concept), and ashore (e.g., a shipyard recycling concept).

9.4 DISCRETIONARY PM PLANS AND DOCUMENTS

9.4.1 ESH Master Plan (ESHMP)

The ESHMP is a PM's plan that contains the details of how the PM will manage all aspects of ESH-related activities. Like any other program master plan, the ESHMP is the PM's roadmap for managing ESH activities. The PM prepares, updates, and approves the ESHMP. It contains the details from which a PESHE can be extracted for the Acquisition Strategy (or SAMP) to support the MDA. As applicable, the ESHMP contains limited discussions of the ESH issues over the last acquisition phase and focuses on those issues to be addressed in the next phase. Well-written ESHMPs address long term (i.e., beyond the next phase) ESH issues only to the extent necessary to highlight how important future issues are being addressed (e.g., disposal). A typical ESHMP for an ACAT I program might be 50 to 100 pages depending on the ESH issues, the complexity of the program, and the phase. *The ESHMP is not required by any DON or DOD policy.*

9.4.2. ILSP

If prepared, the ILSP should address ESH issues within the context of maintenance, support equipment, personal protective clothing, and special training. The Logistics Support Analysis (LSA) should address the specifics of these ESH-related issues and their impacts on both Afloat and Ashore logistics issues.

9.5 OTHER PROGRAM-RELATED DOCUMENTATION

9.5.1. Operational Requirements Document (ORD)

DOD Regulation 5000.-2R[85] contains guidance for preparing the ORD. General ESH issues are included (e.g., system safety, occupational safety and health issues that reduce job performance, and unique environmental compliance issues). PMs should assist the requirements community in clearly defining measurable ESH operational requirements.

[85] DOD Regulation 5000.2R, Appendix II, Operational Requirements Document Mandatory Procedures and Format.

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SECTION 10. MANAGEMENT ISSUES

10.1. ESTABLISH AN ESH MANAGEMENT POLICY

During Concept Exploration, the PM may decide to prepare and issue an ESH Management Policy. This document should clearly and succinctly articulate the PM's personal commitment to the effective integration of ESH considerations. This policy should have wide dissemination across the program office staff, supporting government offices and contractors/consultants, and prime contractors associated with the program. A sample of a PM's ESH Policy is shown in Figure 10.1. PMs who use this type of policy statement will help establish a commitment to the ESH ethic within their programs as discussed in Section 2.

10.2. ESTABLISH AN ESH MANAGER

During Concept Exploration, the PM should appoint an ESH Manager to serve as the PM's primary ESH advisor. This management representative should have authority for ensuring the ESH integration effort is properly planned, established, implemented, and maintained. The ESH Manager should coordinate and manage ESH integration issues and participate in all programmatic reviews. To ensure effective management, the ESH Manager should not be more than three management levels below the PM. In smaller programs, this responsibility may be a collateral duty. In large programs, this should be a full-time job for a single individual, and the responsibilities of this person may also include training of other individuals in ESH integration requirements and assembling teams of experts to address complex ESH issues on an ad hoc basis This person should chair the ESHWG.

10.3. ESTABLISH THE PM'S ESHWG

Staffing to support ESH requirements should start with the assignment of the ESH Manager. For larger and more complicated programs, experts in environment, safety, and health may also be required. For instance, a new construction ship program may elect to have an environmental engineer, a systems safety engineer, an Occupational Safety and Health (OSH) specialist and an industrial hygienist supporting the ESH Manager. For smaller programs, a part-time specialist might be integrated into the program manager's staff through inter-office/agency agreements with organizations such as the Naval Environmental and Health Center or even support contractors.

10.4. ESTABLISH THE PM's ESH ADMINISTRATIVE RECORD FILE

The PM should establish and maintain procedures for internal communications between the various levels and functions of the program. These procedures should include tracking, staffing, and responding to relevant communication from external interested parties regarding the program’s ESH issues.

The PM should establish and maintain the ESH Administrative Record File, in paper or electronic form, that contains pertinent ESH-related information to describe and document the

PM's ESH analyses and decision-making process. The PM should establish and maintain procedures for controlling all documents to ensure that they can be easily located and that the most current revisions/versions are available.

The ESH Manager should be responsible for establishing and maintaining this file. Documentation should be legible, dated (with dates of revision), readily identifiable, maintained in an orderly manner, and retained for a specified period.

XYZ Program Environmental, Safety, and Health (ESH) Policy Statement

This policy applies to all personnel, government and contractors, who participate in the XYZ Program. I am pleased with the program's progress in the area of ESH integration thus far. The effort from Team XYZ is a model for other programs within NAVSEA.

On 15 March 1996, DOD issued Regulation DOD 5000.2-R "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Programs." Of particular interest is the mandatory requirement to conduct ESH analyses to "...integrate ESH issues into the systems engineering process and to support development of the Programmatic ESH Evaluation...."

I suggest each member of Team XYZ review and become familiar with Section 4.3.7 of DOD 5000.2-R. You will note that there are five areas that must be considered in your decision making process: the National Environmental Policy Act (NEPA), ESH Compliance, Safety and Health, Hazardous Materials, and Pollution Prevention. If you have not made these considerations a part of your design trade study, you have not made a fully informed recommendation or decision.

My policy is that every person involved in supporting the XYZ Program is responsible for considering the life cycle ESH impacts of their recommendations and decisions. The current contract, organizational structure, and Integrated Product Teams (IPTs) provide the framework for effectively integrating ESH issues into the XYZ Program's systems engineering process. We must all recognize this integration is not just for environmental managers, system safety engineers, or health specialists. Our ESH experts are there to help you with the ESH integration process. SEA 00T has instituted an Acquisition ESH Integration Workshop to raise your awareness in this important area. This session is mandatory for all Team XYZ participants. In addition, the first version of the XYZ ESH Master Plan has been prepared and should be used as your road map. This master plan will be up-dated annually and your input is necessary to ensure we maintain our proactive initiative.

Effective immediately, all program reviews and IPTs will address integration of ESH considerations. I will assess how well you have addressed this issue from integrated systems engineering and life cycle risk management perspectives and provide my assessment to NAVSEA leadership on an annual basis.

Our goal is to leave a legacy of fielding the best DON (name the type of end-item here; e.g., LPD, CV, gun, propulsion unit, fire suppression system, etc.). Only through your active participation to integrate ESH considerations into the systems engineering process will we accomplish this goal in an environmentally responsible and safe manner.

(your name & signature)

FIGURE 10.1 Sample Program Manager's ESH Policy Statement

10.5 PROVIDE RESOURCES TO SUPPORT THE ESH REQUIREMENTS

Funding for the integration of ESH considerations into the systems engineering process should be planned, programmed, budgeted, and executed like any other programmatic requirement.

When PMs have failed to properly plan, program, budget, and execute their ESH integration efforts, their programs have suffered. Unfortunately, in many cases the lack of planning resulted from a lack of understanding on the part of the PM as to the specific tasks, their timing, and the resources required.

In the case of environmental considerations, on 31 October 1995, the ASN(RDA) issued a memorandum to all PEOs, DRPMs, and Systems Commands which emphasized the importance of identifying funding for pollution prevention initiatives and other environmentally related requirements in weapons system acquisition programs. The memorandum instructed program managers to:

- include an assessment of costs for implementing pollution prevention initiatives in planning for environmental funding. The memorandum emphasized the importance of implementing pollution prevention early in an acquisition program;

- consider the costs associated with using National Aerospace Standard 411 to ensure programs are receiving a net benefit from decisions made as a result of NAS 411 analyses;

- ensure the availability of funding for any NEPA documentation that may be required; and

- work with their resource sponsors during the POM process to ensure the availability of funding for environmental requirements.

In the case of safety and health considerations, MIL-STD-882C provides for the resource planning (both personnel and funding) to ensure that the PM's safety and health tasks are accomplished.

10.6. CONDUCT ESH SELF ASSESSMENTS

PMs can gage the effectiveness of their ESH integration by conducting an ESH self assessment. The following set of metrics is recommended:

NAVSEA
Environmental, Safety, and Health (ESH)
Acquisition Integration Metrics

I. Planning - "The correct things at the correct times"

A. Programmatic ESH Evaluation (PESHE)

(1) Included in Acquisition Strategy (AS) (or Acquisition Plan if no AS)
(2) Reflects current program situation
(3) AS approved by the Milestone Decision Authority (MDA)
(4) Addresses

(a) Strategy for meeting ESH requirements
(b) Establishment of responsibilities
(c) Identification of how program will be tracked

B. Program ESH Master Plan (ESHMP) (optional)

(1) PM's detailed ESH Roadmap
(2) Reflects current program situation
(3) ESHMP approved by PM
(4) Describes how ESH is integrated into systems engineering process
(5) Includes strategy(ies) for

(a) NEPA
(b) ESH Compliance
(c) Safety & Health Program
(d) Hazardous Materials Management Program (HMMP)
(e) Pollution Prevention (P^2) Program
(f) ESH contributions to Life Cycle and Total Ownership Costs

C. T&E decisions influenced by NEPA

(1) Procedures
(2) Documentation
(3) Approval
(4) Mitigation

D. Safety Program - MIL-STD-882C (or equivalent) employed

E. Health Hazards Analyses - MIL-STD-882C (or equivalent) employed

F. HMMP - System/Product Oriented - NAS 411 (or equivalent) employed

(a) Class I and II ODSs prohibited
(b) HAZMATs prioritized
(c) HMMP Plan
(d) HMMP Report

G. P^2 Program

(1) P^2 Strategy
(2) Total life cycle approach

(a) Activities
(b) Acquisition
(c) Afloat

II. Organization - "The correct level of awareness & integration"

A. ESH Manager assigned
B. Not less than three tiers below PM/DRPM
C. Situated to foster integration into systems engineering process

III. Resources - "The correct people & dollars at the right time"

A. People

(1) ACT/IPT participation
(2) Properly trained in ESH Integration Issues
(3) Correct mix of expertise (includes User)

B. ESH-related programs funded

IV. Execution - "Balanced & integrated implementation of ESH plans/strategies"

A. Equal weight to E, S & H issues
B. Decision based on a sound prioritization process

(1) ESH Risk Management Process - Severity & Probability of Occurrence
(2) ESH Hazard Tracking/Acceptance Process

(a) Assigns hazard levels
(b) Identifies and documents approvals
(c) Establishes correct approval levels

(3) ESH contributions to Total Ownership Cost (TOC)

C. Responsibility/Authority Delegation

(1) "Co-locates" responsibility & authority (i.e., empowerment)
(2) Empowers at the correct level of authority

V. Product/Process Improvement - "Continuously looking for effective improvements"

A. Tracking & prioritizing improvements
B. Recognition

(1) Internal (Program recognizes great things)
(2) External (Others recognize Program's great things)

C. User feedback & input to improvement implementation

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APPENDIX A

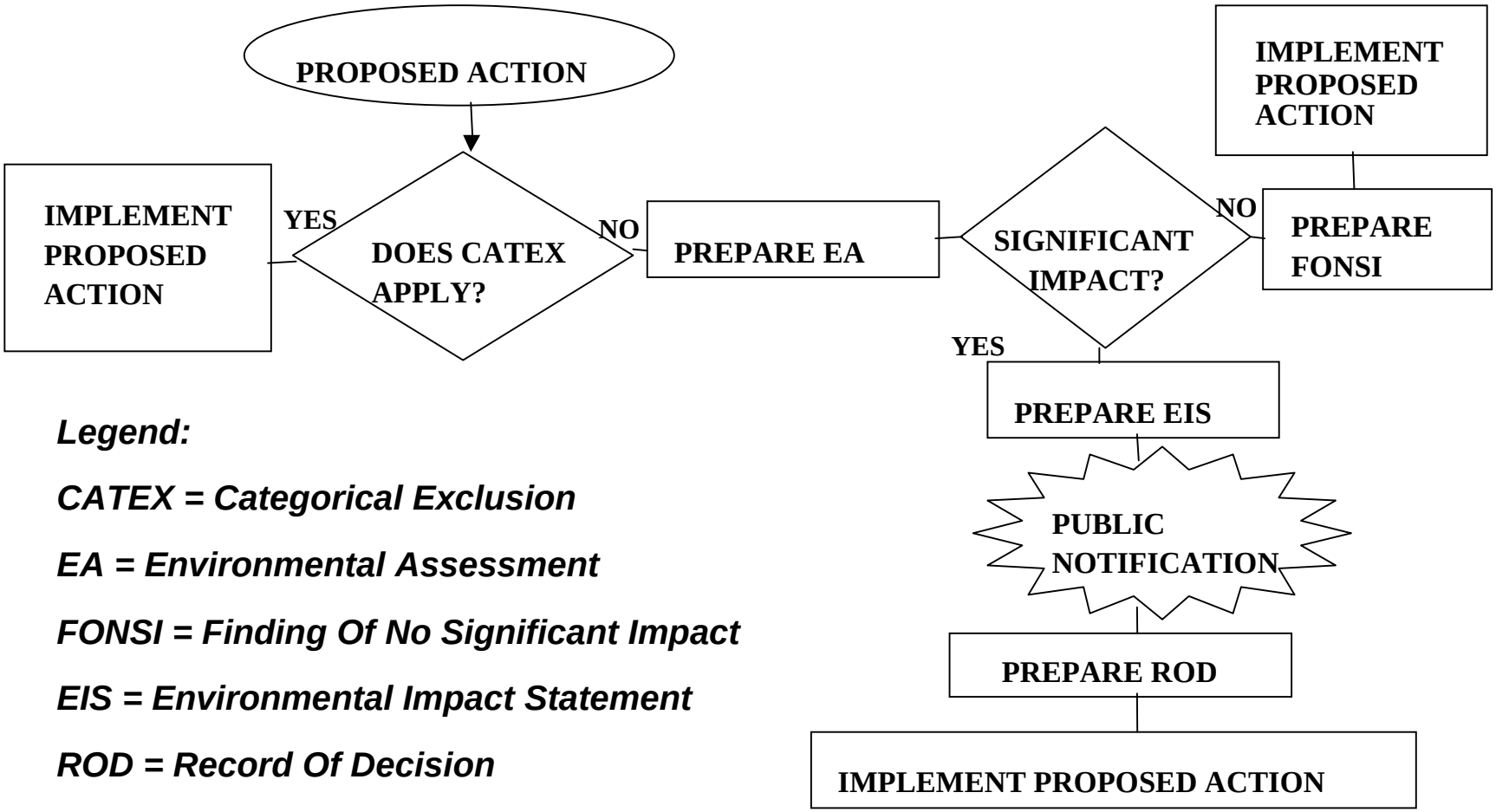
ACRONYMS AND ABBREVIATIONS

ACAT	-Acquisition Category
ACT	-Acquisition Coordination Team
AIA	-Aerospace Industries Association
AP2I	-Acquisition Pollution Prevention Initiative
AS	-Acquisition Strategy
ASN(I&E)	-Assistant Secretary of the Navy for Installations and Environment
ASN(RD&A)	-Assistant Secretary of the Navy for Research, Development, & Acquisition
BACD	-Basic Alteration Class Drawing
CAA	-Clean Air Act
CAE	-Component Acquisition Executive
CATEX	-Categorical Exclusion
CE	-Concept Exploration
CEQ	-Council on Environmental Quality
CFC	-Chlorofluorocarbon
CFR	-Code of Federal Regulations
CI	-Commercial Item
CINC	-Commander In Chief
C/NDI	-Commercial/Non-Developmental Item
CNO	-Chief of Naval Operations
DERA	-Defense Environmental Restoration Act
DID	-Data Item Description
D0D	-Department of Defense
DODD	-Department of Defense Directive
DODI	-Department of Defense Instruction
DODIG	-DOD Inspector General
DOE	-Department of Energy
DON	-Department of Navy
DSMC	-Defense Systems Management College
DT	-Developmental Testing
DU	-Depleted Uranium
EA	-Environmental Assessment
ECP	-Engineering Change Proposal
EIA	-Electronics Industries Association
EIS	-Environmental Impact Statement
EMD	-Engineering and Manufacturing Development
E.O.	-Executive Order
EPA	-Environmental Protection Agency
EPCRA	-Emergency Planning & Community Right-To-Know-Act
ESH	-Environment, Safety, and Health
ESHMP	-ESH Master Plan
FAR	-Federal Acquisition Regulations
FONSI	-Finding Of No Significant Impact
GAO	-General Accounting Agency
HMMP	-Hazardous Materials Management Program
ILSP	-Integrated Logistics Support Plan
IPT	-Integrated Product Team
LCC	- Life Cycle Cost(s)
LSA	-Logistics Support Analysis
MA	-Managing Activity

MDA	-Milestone Decision Authority
MDAP	-Major Defense Acquisition Program
MIL-STD	-Military Standard
MMPA	-Marine Mammal Protection Act
NAS	-National Aerospace Standard
NAVOSH	-Navy Occupational Safety and Health
NAVSEA	-Naval Sea Systems Command
NDI	-Non-Developmental Item
NEPA	-National Environmental Policy Act
NESHAP	-National Emission Standards for Hazardous Air Pollutants
NOV	-Notice Of Violation
NTSP	-Navy Training Systems Plan
ODS	-Ozone Depleting Substance(s)
OPNAVINST	-Chief of Naval Operations Instruction
ORD	-Operational Requirements Document
ORDALT	-Ordnance Alteration
O&S	-Operations and Support
OPTEVFOR	-Operational Test & Evaluation Forces Afloat
OSHA	-Occupational Safety & Health Administration
OSD	-Office of the Secretary of Defense
OT	-Operational Testing
P	-Probability (of occurrence)
PDRR	-Program Definition and Risk Reduction
PEA	-Programmatic Environmental Analysis
PEO	-Program Executive Officer
PESHE	-Programmatic Environmental, Safety, & Health Evaluation
PM	-Program Manager
POM	-Program Objective Memorandum
PP (or P^2)	-Pollution Prevention
PPP	-Pollution Prevention Program
PSNS	-Puget Sound Naval Shipyard
RCRA	-Resource Conservation and Recovery Act
RFP	-Request For Proposals
ROD	-Record of Decision
SAMP	-Single Acquisition Management Plan
SECDEF	-Secretary of Defense
SECNAV	-Secretary of the Navy
SECNAVINST	-Secretary of the Navy Instruction
SHAPM	-Ship Acquisition Program Manager
SHIPALT	-Ship Alteration
SOO/SOW	-Statement of Objectives/Statement of Work
SP or SSP	-Safety Program or System Safety Program
SSWG	-System Safety Working Group
TACP	-Technology Assessment and Control Plan
TEMP	-Test and Evaluation Master Plan
TOC	-Total Ownership Cost(s)
TRI	-Toxic Release Inventory
UNDS	-Uniform National Discharge Standards
USC	-United States Code
USD(A&T)	-Under Secretary of Defense (Acquisition & Technology)
U.S.	-United States
VOC	-Volatile Organic Compound
WSESRB	-Weapon System Explosives Safety Review Board

APPENDIX B

NEPA ANALYSIS AND DOCUMENTATION FLOW



Legend:

CATEX = Categorical Exclusion

EA = Environmental Assessment

FONSI = Finding Of No Significant Impact

EIS = Environmental Impact Statement

ROD = Record Of Decision

APPENDIX C. KEY ESH PLANNING FUNCTIONS BY ACQUISITION PHASE

	Concept Exploration (Phase 0)	Program Definition & Risk Reduction (Phase I)	Engineering & Manufacturing Development (Phase II)	Production, Fielding/Deployment, & Operational Support (Phase III)	In-Service Mod Programs (e.g., ShipAlts, OrdAlts, Conversions)	Demilitarization & Disposal
NEPA	-Analyze & document Phase 0 proposed actions (e.g., DT-0).	-Analyze & document Phase I proposed actions (e.g., DT-I).	-Analyze & document Phase II proposed actions (e.g., DT-II).	-Analyze & document Phase III proposed actions (e.g., DT-III).	-Analyze & document Mods proposed actions (e.g., ShipAlt/OrdAlt testing).	-Analyze & document Demil/Disposal proposed actions.
ESH Compliance	-ID & initiate ESH Compliance database for input to SP, HMMP & PPP	-Update ESH Compliance database for input to SP, HMMP & PPP.	-Update ESH Compliance database for input to SP, HMMP & PPP.	-Update ESH Compliance database for input to SP, HMMP & PPP.	-Update ESH Compliance database for input to SP, HMMP & PPP for Alts.	-Update ESH Compliance database for input to SP, HMMP & PPP for Demil/Disposal.
Safety & Health	-Initiate ESH Hazards Database. -Prepare SOO/SOW for Phase I SP.	-Update ESH Hazards Database. -Prepare SOO/SOW for Phase II SP.	-Update ESH Hazards Database. -Prepare SOO/SOW for Phase III SP.	-Update ESH Hazards Database. -Prepare SOO/SOWs for SP in support of Mods.	-Update ESH Hazards Database for Alts. -Prepare SOO/SOW for Demil/Disposal SP.	-Update ESH Hazards Database for Demil/Disposal.
Hazardous Materials Management	-ID initial target HM list. -Prepare SOO/SOW for Phase I HMMP.	-Update target HM list based on HMMP. -Prepare SOO/SOW for Phase II HMMP.	-Update target HM list based on HMMP. -Prepare SOO/SOW for Phase III HMMP.	-Update target HM list based on HMMP. -Prepare SOO/SOWs for HMMP in support of Mods.	-Update target HM list based on HMMP. -Prepare SOO/SOW for Demil/Disposal HMMP.	-Update target HM list based on HMMP.
Pollution Prevention	-ID initial PP initiatives. -Prepare SOO/SOW for Phase I PPP.	-ID additional PP initiatives. -Prepare SOO/SOW for Phase II PPP.	-ID additional PP initiatives. -Prepare SOO/SOW for Phase III PPP.	-ID additional PP initiatives. -Prepare SOO/SOW for PPP in support of Mods.	-ID additional PP initiatives. -Prepare SOO/SOW for PPP in support of Demil/Disposal.	-ID additional PP initiatives.
Management Issues	-POM for Phase I ESH efforts & tasks. -Prepare & issue ESH Policy. -Establish/charter ESHWG. -Assign ESH manager. -Prepare initial ESHMP & PESHE input to AS. -Initial ESH input to other program plans. -Initiate ESH portion of TOC. -Brief advisory boards (e.g., WSESRB)	-POM for Phase II ESH efforts & tasks. -Update ESH Policy. -Prepare updates to ESHMP & PESHE input to AS. -Update ESH input to other program plans. -Update ESH portion of TOC. -Brief advisory boards (e.g., WSESRB)	-POM for Phase III ESH efforts & tasks. -Update ESH Policy. -Prepare updates to ESHMP & PESHE input to AS. -Update ESH input to other program plans. -Update ESH portion of TOC. -Brief advisory boards (e.g., WSESRB)	-POM for ESH efforts & tasks in support of Mods. -Update ESH Policy. -Prepare update to ESHMP. -Update ESH input to other program plans in support of Mod. -Update ESH portion of TOC. -Brief advisory boards (e.g., WSESRB)	-POM for ESH efforts & tasks in support of Demil/Disposal. -Update ESH Policy. -Prepare update to ESHMP. -If applicable, prepare PESHE input to AS for Mod Program. -Update ESH input to other program plans in support of Demil/Disposal. -Update ESH portion of TOC. -Brief advisory boards (e.g., WSESRB)	-Update ESH Policy. -Prepare updates to ESHMP. -Update ESH input to other program plans, as applicable. -Update ESH portion of TOC. -Brief advisory boards (e.g., WSESRB), as applicable.
Self Assessment	-Establish ESH Self Assessment criteria.	-Conduct ESH Self Assessment.	-Conduct ESH Self Assessment.	-Conduct ESH Self Assessment.	-Conduct ESH Self Assessment.	-Conduct ESH Self Assessment.

APPENDIX D. NAVSEA ENVIRONMENTAL WORKING GROUP

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